**NBR: 200342** **ACRONYM: SISAPEM** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2007-4-3-IRG** **Thema:** PEOPLE-2007-4-3.IRG

**Title:** A contribution to the fundamental understanding of Shear-Refinement of polymer melts by entanglement manipulation

**Abstract:** It has been demonstrated by J-P Ibar that thermal-mechanical history of a polymer melt, in particular the use of mechanical oscillation superposed to shear flow (for instance in the gap of an extruder) appears to boost the magnitude of viscosity and elasticity reduction due to Shear-Refinement. These parameters play a crucial role during processing of plastics, determining the high temperature required to produce flow, thermal degradation, the long cycle times and thus the present productivity limitation in our industries. In the case of loaded polymers, which addresses more than 80% of the polymer resin used today, their high viscosity, aggravated by the presence of the concentrate, limits the maximum amount of dispersants allowed, such as for carbon nanotubes (CNT), as well as the quality of the mix. At the same time, several universities of world wide reputation, including the LPMI of UPPA, the university of Pau et Pays de l'Adour (now called IPREM-EPCP), the Ecole des Mines de Paris (CEMEF Sofia Antipolis) showed that viscosity and elasticity of polymer melts can be reduced by disentanglement of the macromolecules induced by strong deformation. Rheological variables such as strain amplitude, strain rate, elongational ratio, in other words melt thermal-mechanical history, as well as molecular characteristics such as chain molecular weight Mw, degree of branching, branch length, play a critical role to induce chain disentanglement, insure its stability in time, or favor re-entanglement. The objective of this project is to combine the competence of J-P Ibar and that of UPPA-IPREM-EPCP through a collaboration to understand fundamentally the mechanisms of disentanglement and re-entanglement, by Shear Induced Strain Amplified Polymer Entanglement Manipulation (SISAPEM) in order to produce stable disentangled polymers, for instance under pellet form, capable of recovering, after processing, their initial entanglement characteristics and thus their physical performance.

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**NBR: 200431** **ACRONYM: INNOSHADE** **EC FUND: 7555176**

**DG:** RTD **Call: FP7-NMP-2007-LARGE-1** **Thema:** NMP-2007-1.2-1

**Title:** Innovative Switchable Shading Appliances based on Nanomaterials and Hybrid Electrochromic Device Configurations

**Abstract:** INNOSHADE is concerned with an innovative, nanocomposite-based switchable light transmittance technology developed previously for small sized objects (eyewear). It constitutes a breakthrough in smart shading technology by overcoming common limitations of state-of-the-art electrochromic devices. INNOSHADE enables the low cost production of electrochromic shading appliances with lower energy consumption and

faster response. The overall objective of the proposed project is to scale up and study the underlying nanotechnology-based processes from laboratory to pilot line production, with the major goal to explore and extend the application potential by creating interest in several prospective user groups across sectors. In three interrelated sub-projects dedicated to I. Ophthalmic lenses, II. Domestic appliances, and III. Aircraft and vehicle applications, procedures shall be implemented to establish pilot production lines for the individual device components as well as for their assembly to run-capable devices up to a size of 45 x 80 cm2 (automotive sunroof dimensions). Cost reduction will be accomplished via high through-put manufacturing methods such as continuous roll-to-roll processing to achieve demonstrators meeting essential market and consumer requirements. The work will be performed by a highly complementary, well-balanced consortium of 17 partners from seven member states, each one candidate and associate state, and one third country, representing the entire value chain. The proposed research closely addresses main S&T, socio-economic and policy objectives of the NMP work programme (integration of disciplines, transformation to knowledge-intensive industry, improvement of competitiveness, high added value products), shows clear environmental benefits and contributes to Sustainable Development. Strong industrial participation (5 SMEs, 4 large enterprises/multinational global players) reflects the high economic development perspectives of the project.

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**NBR: 200475** **ACRONYM: EMIL** **EC FUND: 999848**

**DG:** ERCEA **Call: ERC-2007-StG** **Thema:** ERC-SG-PE4

**Title:** Exceptional Materials via Ionic Liquids

**Abstract:** Novel and improved nanomaterials with luminescent properties shall be synthesized in ionic liquids (ILs). In this approach the advantages of ionic liquids in nanoparticles synthesis (high nucleation rate, excellent electrosteric nanoparticles (NP) stabilization, morphology control, tunable properties) shall be combined with two unconventional synthesis methods that again take advantage of unique IL properties to obtain unprecedented compounds. Using a completely new and unconventional approach by evaporating metals, intermetallic phases or metal oxides and fluorides under high vacuum (negligible vapour pressure, low flammabilitly of ILs!) into ionic liquids goes far beyond the state of art of nanoparticle synthesis and is expected to have a high technological impact and should offer a way to highly thermodynamically unstable reaction product. Secondly, microwave (MW) irradiation (high polarizability and conductivity of IL ions makes them excellent MW acceptors) of appropriate metal salt/IL solutions should not only lead to NP/IL systems but the reaction of two NP/IL solutions should again lead to otherwise non-accessible reaction products. In combination, new materials with improved properties will be gained. For example, ILs will improve the lifetime of luminescent rare earth (RE)-based systems due to the weaker covalent RE

solvent interaction. Analysis and property determinations of the systems under investigation will involve a variety of aspects of chemistry, physics and materials science.

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**NBR: 200613** **ACRONYM: 3D NANOCHEMISCOPE** **EC FUND: 4033699**

**DG:** RTD **Call: FP7-NMP-2007-SME-1** **Thema:** NMP-2007-1.2-2

**Title:** Combined SIMS-SFM Instrument for the 3-Dimensional Chemical Analysis of Nanostructures

**Abstract:** The objective of this project is to develop an innovative and novel combination of a new TOF-SIMS with substantially improved lateral resolution and sensitivity, combined with a new metrological high resolution SFM. The two techniques provide complementary information on nanoscale surface chemistry and surface morphology. In combination with a layer by layer removal of material using low energy sputtering, quantitatively measured by SFM, this combined ultra-high vacuum (UHV) instrument will be unique for the 3-dimensional chemical characterisation of nanostructured inorganic as well as organic materials with down to at least 10 nm lateral resolution and down to 1 nm depth resolution. Joint by a novel software for the calculation and display of 3-dimensional distributions of all chemical species, this leads to a totally new “3D NanoChemiscope”.

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**NBR: 201031** **ACRONYM: NANOPHOTO** **EC FUND: 2453118**

**DG:** RTD **Call: FP7-HEALTH-2007-A** **Thema:** HEALTH-2007-2.4.1-7

**Title:** Targeted Nanosystems for Improving Photodynamic Therapy and Diagnosis of Cancer

**Abstract:** The overall objective of this proposal is the development of one or more nanosystems loaded with Foscan® and conjugated to cancer cell specific ligands for improving the efficacy and selectivity of photodynamic therapy (PDT) and optimise a fluorescence-based tumour imaging approach. At present, PDT with Foscan® can be very effective but is not selective because Foscan® accumulates in the tumour tissue as well as in healthy ones. A great improvement of the therapy can only come from the availability of a carrier able to seek cancer cells and deliver Foscan® selectively to them. Three types of nanosystems, namely, liposomes, silica nanoparticles or poly(lactide-co-glycolide) copolymer nanoparticles, have been selected as potential nanocarriers for the selective delivery of Foscan®. The selection was mainly based on the different chemical nature of these systems, which can affect biocompatibility. During the first part of the project each type of nanosystem will be optimised through in vitro and in vivo tests and leader nanocarriers will be selected and conjugated to cancer cells specific ligands for

increasing the selective delivery of Foscan®. The ligands we will use (folic acid, EGF, and antibodies) for targeting the nanosystems find their corresponding receptor over-expressed on the surface of cancer cells, therefore allowing a selective delivery of drugs in these cells. In vitro and in vivo investigations will be carried to demonstrate the validity of our approach and deliver, at project conclusion, a final product which can then be tested clinically. Because of the red fluorescence emitted by Foscan®, once it is selectively accumulated in cancer cells fluorescence based technique can be used for tumour imaging and diagnosis. Therefore we expect to develop a Foscan® loaded nanosystem/s which can be used for improving both therapeutic and tumour imaging approaches.

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**NBR: 201227** **ACRONYM: NANOPHENSIM** **EC FUND: 45000**

**DG:** REA **Call: FP7-PEOPLE-2007-2-2-ERG** **Thema:** PEOPLE-2007-2-2.ERG

**Title:** COMPUTER SIMULATIONS OF OPTICAL AND TRANSPORT PHENOMENA IN CARBON NANOTUBES

**Abstract:** The growing realisation of the immense potential for applications of the carbon nanotubes has attracted much attention of scientists. Presently, the nanotube research has become one of the most intensively developing areas of nanotechnology. The principal reason for the amazing electronic and vibrational properties of the nanotubes stems in their quasi-one-dimensionality. The initially existing principal obstacle of normally very large nanotube unit cells, which hindered most of the atomistic simulations on perfect nanotubes, has recently been overcome by using of the screw symmetry of the nanotubes. This allowed for large-scale calculations of phonon dispersion and electronic structure, as well as various optical, thermal, and mechanic properties, of any nanotube of practical interest. The principal objectives of this project are the extension of this symmetry-adapted approach to calculations of other properties and phenomena in nanotubes, which have not been addressed in detail so far. The major topics to be encompassed by the project are: 1) exciton effects, which are of major importance for the optical processes in nanotubes as evidenced by experiments and supported by theoretical arguments, 2) second-order Raman scattering, which can be a source of information for the electronic structure and phonon dispersion of nanotubes but has been described qualitatively only in several limited cases, 3) the phenomenon of photoluminescence, which provides direct information for the structural properties of carbon nanotubes and for the electron (or exciton) – phonon scattering processes, but has not received much attention by theorists, and finally, 4) thermal and electronic transport in nanotubes, which are basic phenomena with importance for building up nano-electronic devices.

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**NBR: 201335** **ACRONYM: NANOTEST** **EC FUND: 2994383**

**DG:** RTD **Call: FP7-HEALTH-2007-A** **Thema:** HEALTH-2007-1.3-4

**Title:** Development of methodology for alternative testing strategies for the assessment of the toxicological profile of nanoparticles used in medical diagnostics

**Abstract:** Nanoparticles (NP) have unique, potentially beneficial properties, but their possible impact on human health has not been adequately assessed. The main goal of this proposal is to develop alternative high-throughput testing strategies using in vitro and in silico methods to assess the toxicological profile of NP used in medical diagnostics. Our specific aims are to: 1. Define NP properties and fully characterize NP to be used 2. Study NP interactions with molecules, cells and organs and develop in vitro methods to study the toxicological potential of NP 3. Validate in vitro findings in short-term in vivo models and study particle effects in animals and (ex vivo) in humans to assess individual susceptibility to NP 4. Develop in silico models of NP interactions Experimental work is structured in 4 WPs to address NP characterisation and key elements in evaluation of NP uptake, exposure and toxicology. NANOTEST integrates the investigation of toxicological properties and effects of NP in several target systems by developing a battery of in vitro assays using cell cultures, organotypic cell culture and small organ fragments (ex vivo) derived from different biological systems; blood, vascular system, liver, lung, placenta, digestive and central nervous systems. As NP action is likely to involve oxidative stress we will focus on the cross-cutting areas of inflammation, cellular toxicity, immunotoxicity, genotoxicity and related endpoints. Following development of SOP and generation of a common database and in parallel with in silico assays (QSAR, PBPK modelling), NanoTest will evaluate toxic effects and interactions of NP used in nanomedicine. Results will be validated in an experimental ethically approved in vivo model. The most advanced and standardised techniques will be adapted for automation and prepared for validation by ECVAM. Separate WPs will be dedicated to dissemination and to effective administrative and scientific management.

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**NBR: 201418** **ACRONYM: READNA** **EC FUND: 11992319**

**DG:** RTD **Call: FP7-HEALTH-2007-A** **Thema:** HEALTH-2007-1.1-3

**Title:** REvolutionary Approaches and Devices for Nucleic Acid Analysis

**Abstract:** The REvolutionary Approaches and Devices for Nucleic Acid analysis – READNA – consortium is composed of researchers from 10 academic institutions, 5 SMEs and 3 large companies. The goals of the READNA consortium are to revolutionize nucleic acid analysis methods, by 1) improving elements necessary to use the currently emerging generation of nucleic acid sequencers in a meaningful and accessible way, 2) providing

methods that allow in situ nucleic acid analysis and methods capable of selectively characterizing mutant DNA in a high background of wildtype DNA, 3) combining RNA and DNA analysis in a single analytical device, 4) providing technology to efficiently analyze DNA methylation (genome-wide, with high resolution and in its long-range context), 5) implementing novel concepts for high-throughput HLA-screening, 6) developing fully integrated solutions for mutational screening of small target regions (such as for screening newborns for cystic fibrosis mutations), 7) developing a device for screening multiple target regions with high accuracy, and 8) implementing strategies for effective and high-resolution genotyping of copy number variations. An important part of READNA is dedicated to the development of the next generation of nucleic analysis devices on individual DNA molecules by stretching out nucleic acid molecules in nanosystems, using alpha-hemolysing nanopores and carbon nanotubes. These approaches will benefit from improved interrogation and detection strategies which we will develop. Our methods and devices will boost the possibilities of genetic research by closing in on the target of 1000 Euros for the sequence of a complete human genome, while at the same time leading a revolution in cost-effective, non-invasive early screening for diseases such as cancer.

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**NBR: 201587** **ACRONYM: ANTICARB** **EC FUND: 2967008**

**DG:** RTD **Call: FP7-HEALTH-2007-A** **Thema:** HEALTH-2007-2.4.1-7

**Title:** Monoclonal ANTIbody-targeted CARBon nanobues against cancer

**Abstract:** ANTICARB attempts to exploit the advantages offered by a novel nanotechnology platform – carbon nanotubes – and apply them to a clinically established therapeutic modality – targeted antibody therapy – for the creation of hybrid nanotechnology-based monoclonal antibody targeted cancer therapeutics. ANTICARB combines two emerging technologies, antibody and nanotube technology, in a way that will allow safe development of antibody-nanotube conjugates and explore their swift translation into a clinical oncology setting. By combining proven, clinically used, anti-cancer agents – antibodies – with a novel nanotechnology-based platform made of advanced nanomaterials, ANTICARB aims at enhancing the therapeutic potency of the antibody and establish a new paradigm for oncology therapeutics. The ability of carbon nanotube technology to transport antibodies into the tumor cell cytoplasm may lead to validation of specific intracellular targets for oncology. This objective will be reached by adopting a multidisciplinary approach and by bringing together expertise from the fields of drug delivery, molecular biology, chemistry, engineering, pharmacology and toxicology. The proposal capitalises on this industry-academia multidisciplinary and perfectly integrated team, whose expertise spans from advanced biotech to sophisticated nanotechnology.

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**NBR: 201729** **ACRONYM: NANOHOST** **EC FUND: 1079630**

**DG:** RTD **Call: FP7-REGPOT-2007-1** **Thema:** REGPOT-2007-1-01

**Title:** Carbon nanohorn-based hybrid materials for energy conversion. Reinforcing and expanding the research potential of carbon-nanostructures laboratory to a regional and European kernel of excellence.

**Abstract:** The objective of NANOHOST project is the unlocking and developing of the research potential of the carbon-nanostructures laboratory (CNSLab), in the Theoretical and Physical Chemistry Institute (TPCI) at the National Hellenic Research Foundation (NHRF), in Athens, Greece. The scientific goal of NANOHOST is the experimental and theoretical investigation of a number of functionalized carbon nanostructures, and in particular nanohorns, selected according to their properties and expected technological applicability for energy conversion systems. In the NANOHOST project, a substantial reinforcement of CNSLab is proposed in terms of i) recruitment of experienced researchers, including possible repatriation of nationals, ii) exchange of know-how and experience through research visits between staff of CNSLab and that of prominent collaborating teams as well as by interaction with other scientists in the context of conferences and meetings, iii) acquisition/upgrade of research equipment, which will enable CNSLab to remain at the forefront of this very competitive area internationally and iv) strengthening of the status of CNSLab, nationally and internationally, through the organization of an international conference, through the promotion and exchange of ideas and knowledge as well as knowledge sharing by other dissemination activities. Such activities will include a website creation and operation and publications as well as participation in international conferences and workshops, popularization activities and public lectures. Thus, the NANOHOST project will enable CNSLab to remain a leader, internationally, in the area of carbon-based nanostructured materials. Furthermore, it will aid CNSLab in the effort to form a kernel in the currently developing scheme of a National Roadmap of Research Infrastructure, which is complementary to the European Road Map for Research Infrastructure as proposed by the European Strategic Forum for Research Infrastructure (ESFRI).

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**NBR: 201739** **ACRONYM: FTMEMS** **EC FUND: 1799915**

**DG:** ERCEA **Call: ERC-2007-StG** **Thema:** ERC-SG-PE6

**Title:** Fiber-top micromachined devices: ideas on the tip of a fiber

**Abstract:** Fiber-top sensors (D. Iannuzzi et al., patent application number PCT/NL2005/000816) are a new generation of miniaturized devices obtained by carving tiny movable structures directly on the cleaved edge of an optical fiber. The light coupled into the

fiber allows measurements of the position of the micromechanical parts with sub-nanometer accuracy. The monolithic structure of the device, the absence of electronic contacts on the sensing head, and the simplicity of the working principle offer unprecedented opportunities for the development of scientific instruments for applications in and outside research laboratories. For example, a fiber-top scanning probe microscope (also in the form of a PenFM, where a fiber-top atomic force microscope would be incorporated in a pen-like stylus) could be routinely used in harsh environments and could be easily handled by untrained personnel or through remote control systems – a fascinating perspective for utilization, among others, in surgery rooms and space missions. Similarly, the development of fiber-top biochemical sensors could be exploited for the implementation of portable equipment for in vivo and Point of Care medical testing. Fiber-top sensors could be used for the measurement of parameters of medical relevance in interstitial fluid or in blood – an interesting opportunity for intensive care monitoring and early detection of life-threatening diseases. This scenario calls for a coordinated research program dedicated to this novel generation of devices. It is my intention to forge a laboratory gravitating around fiber-top technology. My group will have the opportunity to pioneer this research area and to become the reference point in the field, on the forefront of an emerging subject that might represent a major breakthrough in the future development of micromachined sensors.

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**NBR: 201766** **ACRONYM: COMPLEXLIGHT** **EC FUND: 1085000**

**DG:** ERCEA **Call: ERC-2007-StG** **Thema:** ERC-SG-PE2

**Title:** Light and complexity

**Abstract:** The project is aimed at funding a multi-disciplinary laboratory on nonlinear optics and photonics in soft-colloidal materials and on “complex lightwave systems”. A team of talented young researchers, divided among experiments, theory, parallel computation and nano-fabrication is involved. The proposed research will foster several breakthrough discoveries from soft-matter to biophysics, from nonlinear and integrated optics to the science of complexity and cryptography. The underlying vision is driven by the physics of complex systems, those displaying a large number of thermodynamically equivalent states and emergent properties. There are 4 original and high-impact activities, which explore applicative potentialities: 1) sub-wavelength light filaments in soft- and bio-matter; 2) lasers in soft-matter and bio-tissues; 3) control of soft-matter lasers by light filaments; 4) complex lightwave systems, encryption by nano-structured disordered lasers. Activity 1 will lead to ultra-thin re-addressable light beams (sub-wavelength spatial solitons) propagating in soft- and bio-matter that can be used in laser-surgery, matter manipulation and able to guide high power laser pulses; activity 2 attains novel structural diagnostic techniques in bone tissue surpassing limits of nuclear magnetic resonance imaging, and assesses the field of lasers in soft-materials; activity 3 will

demonstrate the control of self-organization processes in soft-matter by light filaments probed by laser emission; activity 4 is based on specific features mutuated from spin-glass theory, and will realize a novel cryptographic technique superior to chaotic systems in terms of security. Activity 1 and 2 are propaedeutic to the others. The team is composed by the Principal Investigator (P.I.), 4 post-doctoral researchers and 3 Ph.D. students. The budget will be used for paying the P.I., two post-doctoral positions, laser sources, high performance computing facilities, and instrumentation.

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**NBR: 201936** **ACRONYM: NANOMAP** **EC FUND: 1670000**

**DG:** ERCEA **Call: ERC-2007-StG** **Thema:** ERC-SG-LS4

**Title:** The Synapse Nanomap

**Abstract:** Stimulated Emission Depletion (STED) microscopy is one of the most important recent developments in light microscopy (Willig et al., 2006, Nature 440:935-9). STED allows for imaging cellular elements with diffraction-unlimited resolution; in practical terms, the resolution (normally limited to ~200-300 nm) is improved down to 30-60 nm. Together with the development of two-color STED microscopy (Donnert et al., 2007, Biophys J. 92:L67-9), this technique allows experimenters to pinpoint the position of various cellular elements with nanometer precision. Obtaining a cellular nanomap is not feasible with conventional light microscopy, due to its low resolution. Electron microscopy cannot be applied, as its labeling efficiency it too low. I propose here to use STED microscopy to characterize the positions of the major components of the synapse. The preparation will be cultured hippocampal neurons, which have numerous small (about one micron in diameter) synaptic nerve terminals. I will determine the locations of synaptic proteins involved in neurotransmitter release, in membrane retrieval and in pre- and post-synaptic active zone structure. Less specialized elements such as the cytoskeleton, mitochondria and endosomes of the synapse will also be investigated. The work will provide answers for a number of questions in the neuroscience field, such as how and where the synaptic vesicles get retrieved, how pre- and post-synaptic active zone elements correlate, and what the role of cytoskeletal elements is in synaptic transmission. The small size and relatively low complexity (compared to whole cells) of the synaptic boutons will allows the work to be completed within a reasonable timeframe. Successful completion of the project will encourage researchers to perform larger scale cellular nano-maps, which would eventually replace the largely erroneous cellular fractionation techniques currently used nowadays to determine the location of various proteins.

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**NBR: 201962** **ACRONYM: TARCC** **EC FUND: 3000000**

**DG:** RTD **Call: FP7-HEALTH-2007-A** **Thema:** HEALTH-2007-2.4.1-7

**Title:** Targeting alpha-particle emitting radionuclides to combat cancer

**Abstract:** This project aims at improving drug delivery to cancer cells by developing targeted radiotherapy with alpha-emitting radionuclides. Alpha particles emitted by radionuclides have short tracks (about 100 microns) in body tissues. As a result, they should be most appropriate to treat small-size tumours and isolated cancer cells. This project proposes the development of improved vectors and targeting technology based on specific targeting agents (recombinant antibody fragments and synthetic peptides), pretargeting approaches and nano-colloids especially designed to deliver alpha-emitting radionuclides to cancer cells after local or systemic administration. The concept of in situ generator, that allows the use of longer half-life parents of alpha-emitting radionuclides will be developed. Several approaches to prevent the release of radionuclides after parent isotope disintegration, including encapsulation in nano-colloids, are proposed. Improved targeting methods will be tested in animal models of small-size tumours and associated dosimetry (including micro-dosimetry) and toxicity studies will be performed. The final goal of the project will be to propose one or several new products for targeted delivery of alpha-emitting radionuclides for clinical development.

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**NBR: 202772** **ACRONYM: SAFETECHNOPACK** **EC FUND: 950000**

**DG:** RTD **Call: FP7-REGPOT-2007-1** **Thema:** REGPOT-2007-1-01

**Title:** Improving the Scientific and Technological Research Capacity of Food Institute on Safety and Technology of Food Packaging

**Abstract:** TUBITAK MRC Food Institute (FI) aims to become one of the leading food science and technology institutes in the EU. In order to achieve its aim FI analysed its weak points, and food packaging technologies are one of them. The main objective of this project is to improve the scientific and technological (S&T) capacity of FI in food packaging technologies. It is believed that FI will increase its participation in FP7 projects by the achievement of this proposal. Specifically, it is aspired to improve the research capacity in chemical contamination from the food contact materials, and developing new food packaging materials using nanotechnology and active antimicrobial packaging technologies. SAFETechnoPACK addresses completely the general objectives of the FP7 REGPOT-2007-1. In order to accomplish the main objective, FI has established the following specific objectives corresponding to the below work packages: •Upgrading S&T equipment infrastructure: involves the upgrading of the S&T equipment infrastructure of FI on packaging technologies, •Recruitment of researchers: involves the recruitment of two researchers in the field of chemistry and polymer science on new packaging technologies, •Networking and co-operative activities: involves participation in international conferences, technical visits to centres in Member States (MSs),

organization of brokerage events, international conference and Advisory board meetings, •Improvement S&T experience and knowledge of researchers: involves the improvement of scientific and technological experience of researchers by long term and short term trainings in MSs, and exchange of know-how and experience by inviting expert scientists from MSs. •Information and dissemination activities: involves the setting up project web page, preparation of leaflets, organisation of info days and participation

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**NBR: 202804** **ACRONYM: TIMER** **EC FUND: 1792800**

**DG:** ERCEA **Call: ERC-2007-StG** **Thema:** ERC-SG-PE3

**Title:** TIME-Resolved Spectroscopy of Nanoscale Dynamics in Condensed Matter Physics

**Abstract:** The main goal of this project is the development of an inelastic photon scattering spectroscopy that will benefit from the advent of the new generation of ultra bright light sources. The current construction of the free electron laser FERMI by Sincrotrone Trieste, is expected to make available VUV photon pulses with unique characteristics and therefore calls for the development of the proposed technique in Trieste. The idea is to extend the standard transient grating spectroscopy towards higher energies in a way such that nanoscale dynamics may be investigated. This would be extremely interesting to better understand the physics of disordered systems since it will make accessible the mesoscopic kinematic region that cannot be explored by the use of visible laser or synchrotron based instruments. Transient grating experiments at the nanoscale could also allow sensitive probing of interfaces and extremely thin films, as well as heat transport and correlations in nanostructured materials. ERC funding will allow the PI transition from his current position as junior beam line scientist at the Elettra facility, to an independent research group leader status at the FERMI laboratory for conducting experiments that will be relevant to many research fields at the frontier in physics and chemistry.

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**NBR: 202897** **ACRONYM: MIMOMEMS** **EC FUND: 1100000**

**DG:** RTD **Call: FP7-REGPOT-2007-1** **Thema:** REGPOT-2007-1-01

**Title:** European Centre of Excellence in Microwave, Millimetre Wave and Optical Devices, based on Micro-Electro-Mechanical Systems for Advanced Communication Systems and Sensors

**Abstract:** The aim of the MIMOMEMS project is to bring the research activity in RF and Optical-MEMS at IMT-Bucharest to the highest European level and create a European Centre of

Excellence in Microwave, Millimetre Wave and Optical Devices, based on Micro-Electro-Mechanical Systems (MEMS) for Advanced Communication Systems and Sensors The main objectives of the project support high level research activities in RF and Optical MEMS, through the following objectives: i. Know-How and Experience Exchange: Twinning actions with two research centres: a) LAAS-CNRS Toulouse with a strong expertise in silicon based millimetre wave microsystems and photonic devices, and b) FORTH-IESL-MRG Heraklion with excellent knowledge of IIIV's ii. Recruitment by IMT:. Post-Docs. with expertise in nanophotonics and microwaves, will be hired for increasing IMT s human potential iii. Development and Upgrade of Research Equipment: About 50% of project founds will be used for the upgrading and purchasing new equipments (on wafer characterization up to 110GHz, new nano-characterization equipment – SNOM, etc) iv. Workshop, Conference Organisation and Policy Development. Organize of scientific events, thematic sessions and seminars supporting knowledge transfer and research policy development v. Dissemination and Promotional Activities: Promotion of activities and results through a project website; publication in reviewed journals and conferences; organization of workshops, FP7 proposals. The MIMOMEMS project will directly address research objectives from FP7 Work Programmes: 1.Capacities - Part 4 - Research Potential. Activity: 4.1.Unlocking and developing the research potential in the EU´s convergence regions and outermost regions 2.Cooperation – Theme 3 - ICT. Challenge 3: Components, systems, engineering:3.1; 3.5; 3.6 Objective.3.1: Next-Generation Nanoelectronics Components and Electronics Integration Objective.3.5: Photonic components and subsystems Objective 3.6: Micro/nanosystem

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**NBR: 203043** **ACRONYM: NANOFIB** **EC FUND: 1228736**

**DG:** ERCEA **Call: ERC-2007-StG** **Thema:** ERC-SG-PE6

**Title:** Nano fibrous materials - structure, design and application

**Abstract:** The performance and physical attributes of a material and product can be tailored to so far unmatched material strengths and properties by creating new nano fibrous structures from polymers by electrospinning. The electrospinning process uses an electric field to produce charged jets of polymer solutions or melts. Bending instabilities of the jet, caused by the surface charge, lead to extremely high local extension rates of the jet and produce fibres with diameters of the order of a few nanometer that consist of highly aligned polymer strands. However, the biggest unsolved problem of the electrospinning process is the sensitive equilibrium between surface tension, viscosity, elasticity and conductivity of the polymer solutions. These are controlled by molecular parameters as the molar mass, chemical microstructure, conformation in solution or supramolecular structures via intermolecular interactions. The optimal combination of these parameters is, as yet, unknown. Within this project, a novel and unique technical platform will be developed and installed, that is generally capable to image and analyse high speed free surface flows in miniaturised dimensions. This platform will then be

utilized to analyse electrospinning process parameters and to connect them to the material properties and the molecular structure of the polymer solution. Only such a fundamental understanding of the relation of these properties to the flow and mass transfer phenomena on the micro-time and -dimensional scale will allow to design in the second part of this project the required structural and material properties of nano-scale fibres for: -novel fibre/matrix composites for the creation of ultra-high-strength hydrogel membranes; -short fibre morphologies created by a novel controlled disruptive spinning process at the boundaries of the parameter space; -tailoring of fibre properties from renewable resources by modification of the chemical side-chain structure of polysaccharides.

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**NBR: 203239** **ACRONYM: NOMAD** **EC FUND: 1517779**

**DG:** ERCEA **Call: ERC-2007-StG** **Thema:** ERC-SG-PE3

**Title:** Nanoscale Magnetization Dynamics

**Abstract:** The aim of NOMAD is to develop frontier approaches to control the magnetodynamic properties of nanometer-sized molecular and metallic elements. The first part of the project recognizes the importance of molecular materials for future technologies based on magnetoelectronic devices. It addresses the stabilization of the magnetic moment of individual molecules beyond their intrinsic limits (slow timescale). Moreover, the construction of spin-sensitive probes with spatial atomic-resolution and a dynamic range extending up to the GHz regime is proposed. These shall be used to characterize magnetodynamic phenomena of individual molecules and metal particles in a nanoscopic environment (fast timescale). The second part relates to the control of magnetic relaxation and coercivity in nanoscale metallic particles. Electric-field manipulation of ferromagnetism has been proven in dilute magnetic semiconductors at temperatures below 50 K. Here, the aim is to demonstrate and optimize electric field-induced changes of the magnetic anisotropy energy in metal layers and nanoparticles embedded in a double tunnel junction, providing a direct or indirect (transition-driven) handle to their magnetic dynamics at room temperature. Metal-based materials constitute the mainstay of present magnetic technology; their electric-field actuation would lead to simpler and power-saving devices that process magnetic information using electrical signals.

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**NBR: 203428** **ACRONYM: NMU-LIPIDS** **EC FUND: 1941000**

**DG:** ERCEA **Call: ERC-2007-StG** **Thema:** ERC-SG-PE6

**Title:** Biomimetic Lipid Structures on Nano- and Microfluidic Platforms

**Abstract:** The projects aim at the formation, manipulation, and analysis of three-dimensional lipid membrane structures on micro- and nano-structured platforms. The goal is to develop a novel methodology to design and create simple artificial cells and cell organelles, bio-hybrid cells, and bio-mimicking membrane networks, which could be an entirely novel tool for cell analysis, and promises fascinating prospects for cell manipulation, biotechnology, pharmacy and material sciences. The basis of the projects is formed by an unconventional concept that involves two current cutting-edge fabrication technologies, i.e. the so-called top-down and bottom-up approaches. The combination of the two approaches, with respect to both engineering methods and biological applications, opens the door to overcome current limitations in the creation of complex soft matter objects in micro- and nanometre dimension. The key method is a recently developed micro-extrusion process. It relies, on the one hand, on the ability of the lipid molecules to self-assemble ("bottom-up"). On the other hand, photolithography processes ("top-down") are utilized to fabricate microchips, in which shape transformation, handling and analysis of the lipid structures are performed. The proposed engineering process will enable, for the first time, to precisely design composition, size and morphology of complex membrane structures. It will provide the requirements to design an artificial cell of reasonable complexity ("bottom-up"). One main emphasis is the creation of unique bio-hybrid systems, in which artificial membrane structures are connected to living cells, or in which natural membranes of cells are integrated within artificial systems ("top-down"). This highly interdisciplinary study will further include fundamental studies on membrane properties, engineering aspects to generate novel soft-matter devices, and the development of analytical methods and lipid sensors based on micro- and nanostructured chips.

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**NBR: 203459** **ACRONYM: WOOD-NET** **EC FUND: 1049320**

**DG:** RTD **Call: FP7-REGPOT-2007-1** **Thema:** REGPOT-2007-1-01

**Title:** The implementation of research potential of the Latvian State Institute of Wood Chemistry in the European Research Area

**Abstract:** The project's objective is to improve the research capacities and to reinforce the S&T potential of the Latvian State Institute of Wood Chemistry (LSIWC) in its scientific excellence with the aim of unlocking its capacity and make it accessible for ERA; to strengthen LSIWC as a central part, which ensures the smooth integration of researchers from convergence and outermost regions in a field vital for the social-economic development of Europe and Latvia such as Forestry and Forest Products. The project embraces thematic priorities such as the investigation of the structure and biodegradation of wood as a construction material and a cultural historical object to ensure its durability and competitiveness in the changing climate and biodiversity

conditions; interdisciplinary theoretical wood studies on the molecular and nano-level, and development of technologies for chemical compounds, production of composite materials and energy from wood, its components and other types of biomass; rational utilization of woodworking and wood processing residues for the development of innovative multifunctional products for agriculture, forestry and environment protection. The project will promote the exchange of know-how and experience, formation of strategic co-operation partnership between the related leading European research centres. It will activate the dissemination of scientific information and joint results, will expand the involvement of young researchers in the scientific environment. The project envisages the acquisition of unique research equipment and upgrading of the existing one, which will extend the research potentialities, strengthen the Institute as an international research centre and make it attractive for the co-operation partners. 51 institutions as provisional cooperation partners from 24 countries will predicted: 41 from 20 ERA countries (between them 14 from 9 new EU countries); 10 from 4 ICPC (Eastern European and Mediterranean) countries.

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**NBR: 203690** **ACRONYM: NANOTRANSDUCER** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2007-4-3-IRG** **Thema:** PEOPLE-2007-4-3.IRG

**Title:** Modeling and Design of Thin Film Waveguides Terminated with Nano-optical Transducers

**Abstract:** Nano-optics is a rapidly growing field with potential uses in many practical applications. Near-field optical techniques that enhance localized surface plasmons are potential candidates for obtaining intense optical spots beyond the diffraction limit for various practical applications. Nano-optical transducers can be utilized in a traditional optical system to obtain spots beyond the diffraction limit. This system has a number of disadvantages for potential use in consumer electronic markets due to its large body mass, size, price, and difficulties in mass production. A thin film waveguide with planar optical lenses and mirrors having a nano-optical transducer around the focus can address these problems. In this work electromagnetic and thermal modeling and design tools will be developed to investigate this device. A volume integral equation based solution will be used for the solution of Maxwell's equation, and a finite element method based solution will be used for the solution of heat transfer equation. Designs will be identified to obtain small optical spots beyond the diffraction limit. Designs will also be optimized to obtain high transmission efficiency, which is necessary for practical applications such as data storage. The heating of the designs will be investigated.

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**NBR: 203872** **ACRONYM: COMOSYEL** **EC FUND: 1439712**

**DG:** ERCEA **Call: ERC-2007-StG** **Thema:** ERC-SG-PE3

**Title:** Complex Molecular-scale Systems for NanoElectronics and NanoPlasmonics

**Abstract:** COMOSYEL aims at designing complex nanometric and molecular systems to process electronic or optical information from the macroscopic to the molecular scale. It proposes two specific, unconventional approaches to molecular electronics and plasmonics and the development of two multidisciplinary technical toolkits, one in bio-inspired chemistry and one in surface nanopatterning by liquid nanodispensing that will support the first two topics, and eventually become a part of the team's culture for future research developments. (1) Graphene-based nanoelectronics is an experimental implementation of mono-molecular electronics concept using graphene to bridge the macroscopic world to the molecular scale. This topic aims at encoding and processing electronic information in a single complex molecular system in order to achieve complex logic functions. (2) Self-assembled nanoplasmonics aims at developing a molecular plasmonics concept. Here, complex networks of sub-20nm crystalline metallic nanoparticle chains are produced and interfaced to convert photons to plasmons and ultimately confine, enhance and route light energy from a conventional light source to an arbitrary chromophore on a substrate. (3) Bio-inspired nanomaterials chemistry will be the main synthetic tool to produce new multifunctional nanostructured materials able to address and collect information from/to the macroscopic world to/from the single molecule level. Both morphogenesis and self-assembly will be explored to better control size and shape of nano-objects and the topology of higher-order architectures. (4) Liquid nanodispensing is a promising tool to interface nanosized/molecular sized systems with both lithographically produced host structures and individual molecular systems. A nanoscale liquid dispensing technique derived from AFM combines resolution and versatility and will be pushed to its extreme to master the deposition of nanoobjects onto a substrate or a precise modification of surfaces.

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**NBR: 203953** **ACRONYM: UNAM-REGPOT** **EC FUND: 949999**

**DG:** RTD **Call: FP7-REGPOT-2007-1** **Thema:** REGPOT-2007-1-01

**Title:** Strengthening of Materials Science and Nanotechnology Institute of Turkey as a National Centre of Excellence through European Integration

**Abstract:** The newly established Materials Science and Nanotechnology Institute (UNAM) is the first national research institute of Turkey in the area of atomic scale materials and nanotechnology. UNAM is growing as a major research facility equipped with all necessary research infrastructure and advanced research tools to carry out forefront R&D activities. This advanced research facility is available to the researchers of all other institutions. As a centre of excellence, UNAM is expected to provide scientific advising for the state of the art research problems in nanotechnology. Through this project, the

Institute can rapidly reach its full potential for research and technological innovation and emerge as an internationally competitive center, integrated firmly into the European Research Area. UNAM is recently established; despite wide recognition within Turkey, so far our exposure to the European scientific community has been limited. We strongly desire to improve this and develop connections to and collaborations with European laboratories, university groups and research institutes through mechanisms to be established in this project. However, UNAM currently suffers from a bottleneck in funding of travel, conference organization. In addition, UNAM needs to increase its PhD staff through postdoctoral and research scientist positions, since full faculty positions through the university are very limited. There is need for a number of trained personnel in high-technology equipment relevant to nanotech in Turkey, such TEM, FIB, lithography equipment. The proposed project will allow UNAM administration to offer internationally competitive salaries for young Turkish scientists receiving doctorates every year in the USA, reversing the brain drain, as well as young European scientists with technical expertise. The proposed project will be critical in overcoming all of these difficulties.

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**NBR: 204953** **ACRONYM: RP-DEMATEN** **EC FUND: 499983**

**DG:** RTD **Call: FP7-REGPOT-2007-3** **Thema:** REGPOT-2007-3-01

**Title:** Reinforcement of research potential of the Department of Materials Engineering in the field of processing and characterization of nanostructured materials

**Abstract:** The Department of Materials Engineering (DEMATEN) at the Faculty of Technology, University of Novi Sad represents the strongest research and education centre in the province Vojvodina in the field of ceramics and polymer materials and one of the first research centres in Serbia in which investigation of nanostructured materials has begun in early 1990's. Since then the research activities at DEMATEN have been focused on processing and characterization of nanostructured materials: nanopowders, nanotubes, nanofilms, nanocomposites. The objectives of the proposed project are reinforcement of research potential of DEMATEN and strengthening partnerships among centres of excellence established in the EU's convergence region, the Member States and the Western Balkan Countries (WBC). This will be realized by: i) improving networking and exchanging of know-how and experience among the countries concerned through trans-national two-way secondments of research staff; ii) sending young scientists in the EU centres for training or to carry out specific research experiments; iii) reinforcing the human potential of DEMATEN (and three research centres from the EU's convergence region) by hiring new young researchers; iv) upgrading and renewal of S&T research equipment and v) organising of workshops and conference. Achievement of these goals should enable the research group of DEMATEN to become expert and competent in the challenging field of nanomaterials and nanotechnology, to reinforce the WBC research potential and to contribute to sustainable research development by reinforcing S&T

potential. The proposed project will explore the synthesis, characterization and processing of nanostructured materials as well as their integration into novel technologies. Realization of the project would facilitate integration of DEMATEN into the European research area as an appropriate partner in fundamental as well as applied research projects.

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**NBR: 205533** **ACRONYM: REGMINA** **EC FUND: 799996**

**DG:** RTD **Call: FP7-REGPOT-2007-1** **Thema:** REGPOT-2007-1-01

**Title:** Reinforcement of Regional Microsystems and Nanosystems Centre

**Abstract:** The Centre of Microelectronic Technologies and Single Crystals, a department within the Belgrade-based Institute of Chemistry, technology and Metallurgy, is the only Serbian institution fully dedicated to research in the fields of microsystems and nanosystems. It is oriented to applied research of different solid-state sensors and detectors, microelectromechanical (MEMS) and microoptoelectromechanical (MOEMS) structures and nanostructures for a wide range of practical applications, including industry, environmental protection, health protection, etc. The Centre covers all stages of a research cycle, starting from the fundamental theory, proceeding with simulation, micro- or nanofabrication and characterization and ending with a finished device. Our vision is to boost the Centre into a regional centre of excellence in sensor micro- and nanosystems, enabling it to fully integrate into the EU research, at the same time ensuring a sustainable growth of its research resources and wider coverage of topics. To this purpose a reinforcement of labs is necessary, continual improvement of knowledge base and skills through training and increased mobility of research personnel, networking and joint research with EU teams, but also enhancement of the Centre's visibility through knowledge dissemination to both experts and the general public. The Centre already possesses a number of advanced technologies and a large expertise and know-how in numerous fields of semiconductor science, planar technology including photolithography, chemical engineering, thin film technologies, micromachining and other procedures specific for microsystem and nanosystem technologies. In this moment the teams of the Centre are engaged in a number of modern topics, including microcantilever-based nanosensors, cavity-enhanced optical detectors and novel sensors utilizing photonic bandgap materials and electromagnetic metamaterials.

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**NBR: 205537** **ACRONYM: ADONIS** **EC FUND: 1296000**

**DG:** ERCEA **Call: ERC-2007-StG** **Thema:** ERC-SG-PE2

**Title:** Attosecond Dynamics On Interfaces and Solids

**Abstract:** New insight into ever smaller microscopic units of matter as well as in ever faster evolving chemical, physical or atomic processes pushes the frontiers in many fields in science. Pump/probe experiments turned out to be the most direct approach to time-domain investigations of fast-evolving microscopic processes. Accessing atomic and molecular inner-shell processes directly in the time-domain requires a combination of short wavelengths in the few hundred eV range and sub-femtosecond pulse duration. The concept of light-field-controlled XUV photoemission employs an XUV pulse achieved by High-order Harmonic Generation (HHG) as a pump and the light pulse as a probe or vice versa. The basic prerequisite, namely the generation and measurement of isolated sub-femtosecond XUV pulses synchronized to a strong few-cycle light pulse with attosecond precision, opens up a route to time-resolved inner-shell atomic and molecular spectroscopy with present day sources. Studies of attosecond electronic motion (1 as = 10-18 s) in solids and on surfaces and interfaces have until now remained out of reach. The unprecedented time resolution of the aforementioned technique will enable for the first time monitoring of sub-fs dynamics of such systems in the time domain. These dynamics – of electronic excitation, relaxation, and wave packet motion – are of broad scientific interest and pertinent to the development of many modern technologies including semiconductor and molecular electronics, optoelectronics, information processing, photovoltaics, and optical nano-structuring. The purpose of this project is to investigate phenomena like the temporal evolution of direct photoemission, interference effects in resonant photoemission, fast adsorbate-substrate charge transfer, and electronic dynamics in supramolecular assemblies, in a series of experiments in order to overcome the temporal limits of measurements in solid state physics and to better understand processes in microcosm.

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**NBR: 205896** **ACRONYM: CEESC** **EC FUND: 1296000**

**DG:** ERCEA **Call: ERC-2007-StG** **Thema:** ERC-SG-PE3

**Title:** Control of entangled electron spins on a chip

**Abstract:** The promise of nanoscience stems from the fundamentally new behavior that emerges at the nanoscale. Here, we propose to explore, control and exploit one of the most dramatic aspects of this unusual behavior: quantum entanglement of spins. Our nanoscale system of choice is an array of semiconductor quantum dots that each contain one single electron. Thanks to a string of recent breakthroughs, it is now possible to initialize, coherently manipulate and read out the spin state of one such electron, and to couple it coherently to a spin in a neighboring dot. Today, we are at the brink of a new era in this field, in which entanglement will play the central part. The primary goal of this proposal, therefore, is to experimentally demonstrate that electron spins in quantum dots can really be entangled, and to control this entanglement in time.

We will then use this capability to implement various quantum information protocols such as quantum algorithms and teleportation, which intrinsically rely on entanglement to realize tasks that are classically impossible. In order to push the level of coherent control to its limits, we will suppress fluctuations in the normally uncontrolled spin environment, and pursue novel quantum dot technologies which offer an intrinsically 'quiet' environment. Our long-term dream is to demonstrate that the accuracy threshold for fault-tolerant quantum computation can be reached in this system, which would permit quantum coherence and entanglement to be preserved indefinitely. This research is presently very much at the stage of exploratory research and is bound to produce surprising and unexpected outcomes. Furthermore, we are convinced that pushing the frontier of quantum control in nanoscale devices has a real potential to lead to future quantum technologies.

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**NBR: 206807** **ACRONYM: NATURALE** **EC FUND: 1643021**

**DG:** ERCEA **Call: ERC-2007-StG** **Thema:** ERC-SG-PE6

**Title:** Bio-Inspired Materials for Sensing and Regenerative Medicine

**Abstract:** Materials with nanometre-scale dimensions have unique functional properties that can lead to novel engineering systems with highly useful characteristics. Most traditional approaches to synthesis of nanoscale materials, unlike those in biology, require stringent conditions and often produce toxic byproducts. Within biology itself, biomaterials are highly organized from the molecular to the nanoscale, with intricate architectures that allow for optimum functionality. The focus for this proposal on bio-inspired materials is two-fold. In the first instance I aim to rationally design biologically responsive peptides to control the assembly and dis-assembly of bio-inorganic nanostructures and develop fundamental enabling technologies with applications in bio-sensing. The second focus is on exploiting our understanding of the natural biological nanostructures found in the complex extracellular matrix of tissues in order to engineer synthetic biomimetic nanostructures for improved cell growth and tissue regeneration. Outcomes will include greater fundamental understanding of cell-matrix interactions and cell differentiation as well as longer-term clinical impacts. I have begun to establish a creative research team with many developing international links and a record of timely high quality research. If successful with this proposal I will be able to manage my group to its full potential and to expand its influence and vision. The proposed research involves development of important new international collaborations in the basic sciences and is highly multidisciplinary in nature encompassing elements of engineering, biology, chemistry and physics and ranging from high-resolution techniques of surface analysis to peptide design and cell biology.

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**NBR: 206872** **ACRONYM: LIVENUCESC** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2007-4-3-IRG** **Thema:** PEOPLE-2007-4-3.IRG

**Title:** Live imaging of nuclear dynamics in embryonic stem cell differentiation

**Abstract:** Owing to their unique ability to self-renew indefinitely, as well as their capacity to differentiate into multiple cell types of all three germ layers, embryonic stem (ES) cells hold great promise both as therapeutic agents in the clinic and as research tools in the lab. One of the main challenges in the field is understanding how stem cells achieve their remarkable potential. Recent efforts by us and others have shown that chromatin itself serves as a major contributor to ES cell identity and plasticity. While most of the supporting data emerges from biochemical and molecular studies, I propose here to use live cell imaging techniques and advanced microscopy to probe the transcriptional machinery and chromatin dynamics in living differentiating ES cells. I aim to elucidate the dynamic changes that occur in chromatin structure and function during early ES cell differentiation events. Using photobleaching methods (i.e. FRAP) complemented by biochemical approaches, I will study the dynamic interplay of both transcriptional activators (e.g. Oct-4, Nanog) and transcriptional repressors (e.g. Polycomb Group proteins) with chromatin. Also, using the spinning disk confocal technology I will monitor in real time, changes in chromatin structure, as well as the dynamics of chromatin-protein interactions in living cells. Finally, using ES cell lines carrying a labeled genomic locus at random sites I will be able to directly visualize chromatin motion in living cells. These experiments will provide new insights into the mechanisms that govern chromatin-regulated differentiation events and chromatin dynamics in living cells as well as stem cell identity and pluripotency.

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**NBR: 206966** **ACRONYM: SUMCL** **EC FUND: 34901**

**DG:** RTD **Call: FP7-REGPOT-2007-2** **Thema:** REGPOT-2007-2-01

**Title:** Improving the Research Capacity for Nanoscale Materials Characterization

**Abstract:** The purpose of this proposal is to evaluate the research program and existing infrastructure in our materials characterization lab and seek recommendations for improvement to enhance our research potential for nanoscale studies and increase our participation in FP7. Currently, many projects funded at the national level have achieved limited success in developing high tech materials that exploit nanoscale phenomena. There is a clear need for microstructural and chemical evaluation capabilities at the sub-5-nm scale.

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**NBR: 207441** **ACRONYM: DEDOM** **EC FUND: 1250000**

**DG:** ERCEA **Call: ERC-2007-StG** **Thema:** ERC-SG-PE4

**Title:** Development of Density Functional Theory methods for Organic Metal Interaction

**Abstract:** First principles Density-Functional Theory (DFT) methods have been widely applied for computing electronic and optical properties of different systems. Recently theoretical modeling of metal-organic interfaces received a much attention due to their importance in different nanoscience fields. However, common (i.e. local and semi-local) approximations to the exchange-correlation (XC) functional of DFT show several shortcomings in describing metal-organic energy-levels alignment and thus charge-transfer. Aim of the DEDOM (DEvelopment of Density functional theory methods for Organic Metal interaction) project is to elaborate new theoretical methods beyond the current state-of-the-art for the description of the electronic and optical properties of organic molecules linked or deposited on metal surfaces or metal nanoparticles. This task includes: i) the development of new and efficient XC functionals, based on optimized effective potential (OEP) and including exact-exchange and correlation from many-body theory, to obtain an accurate description of charge-transfer between organic molecules and metal surfaces; ii) the investigation of optical properties, including light-emission, of organic molecules on metal surfaces using Time-Dependent DFT; iii) the description of metals using Green's functions and multi-scale approaches to investigate metal-induced modification of the optical properties of organic molecules, including fluorescence quenching or enhancement due to the coupling of electronic excitations to plasmons. The DEDOM project is theoretically and technically extremely challenging due to the use of unconventional orbital-dependent XC-functionals and it requires a strong interdisciplinary effort, joining solid-state physics, theoretical chemistry, electromagnetic engineering and implementation of advanced computational techniques. If successful, it will represent a major progress in the theoretical description of organic-metal interfaces.

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**NBR: 207467** **ACRONYM: DECORE** **EC FUND: 1509200**

**DG:** ERCEA **Call: ERC-2007-StG** **Thema:** ERC-SG-PE8

**Title:** Deep Earth Chemistry of the Core

**Abstract:** Core formation represents the major chemical differentiation event on the terrestrial planets, involving the separation of a metallic liquid from the silicate matrix that subsequently evolves into the current silicate crust and mantle. The generation of the Earth's magnetic field is ultimately tied to the segregation and crystallization of the core, and is an important factor in establishing planetary habitability. The processes that

control core segregation and the depths and temperatures at which this process took place are poorly understood, however. We propose to study those processes. Specifically, the density of the core is lower than would be expected for pure iron, indicating that a light component (O, Si, S, C, H) must be present. Similarly, the Earth's mantle is richer in iron-loving ("siderophile") elements, e.g, V, W, Mo, Ru, Pd, etc., than would be expected based upon low pressure metal-silicate partitioning data. Solutions to these problems are hampered by the pressure range of existing experimental data,< 25 GPa, equivalent to ~700 km in the Earth. We propose to extend the accessible range of pressures and temperatures by developing protocols that link the laser-heated diamond anvil cell with analytical techniques such as (i) the NanoSIMS, (ii) the focused ion beam device (FIB), (iii) and transmission and secondary electron microscopy, allowing us to obtain quantitative data on element partitioning and chemical composition at extreme conditions relevant to the Earth's lower mantle. The technical motivation follows from the fact that the real limitation on trace element partitioning studies at ultra high-pressure has been the grain size of the phases produced at high P-T, relative to the spatial resolution of the analytical methods available to probe the experiments; we can bridge the gap by combining state-of-the-art laser heating experiments with new nano-scale analytical techniques.

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**NBR: 207542** **ACRONYM: TRICEPS** **EC FUND: 909999**

**DG:** ERCEA **Call: ERC-2007-StG** **Thema:** ERC-SG-PE2

**Title:** Time-resolved Ring-Cavity-Enhanced Polarization Spectroscopy: Breakthroughs in measurements of a) Atomic Parity Violation, b) Protein conformation and biosensing and c) surface and thin film dynamics

**Abstract:** Polarimetry is a crucial tool in both fundamental and applied physics, ranging from the measurement of parity nonconservation (PNC) in atoms, to the determination of biomolecule structure, and the probing of interfaces. These measurements tend to be extremely challenging as the change of the polarization of light is usually extremely small; typical differences in polarization states are of the order of 10^-5 to 10^-8. Current experimental techniques often require acquisition times of the order of seconds or, in the case of PNC, even many days, limiting the possibilities of time-resolved measurements. Here, I propose to develop optical-cavity-based techniques which will enhance measurements of the polarization sensitivity and/or the time-resolution by 3-6 orders of magnitude. Preliminary data from prototypes and feasibility studies are presented. I propose to demonstrate how these breakthroughs will revolutionize polarimetry, by addressing some of the most important multidisciplinary problems in fundamental physics, biophysics, and material science: a) Testing the limits of the Standard Model with atomic PNC measurements. Current PNC experiments, and more importantly theory, for cesium atoms are limited to precision of about 0.5%. The novel and robust experimental technique I am proposing here affords 4 orders-of-magnitude

higher sensitivity, thus giving access to lighter atoms, where the theory can be better than 0.1%, for the most stringent test of the Standard Model, while seeking new physics. b) The measurement of protein folding dynamics. Highly sensitive time-resolved spectroscopic ellipsometry, providing novel dynamical information on protein folding: nanosecond resolved, position measurements of functional groups of surface proteins, which map out the time-dependent protein structure. c) Determination of thin film thickness and surface density with nanosecond resolution, for the study of processes such as laser ablation and polymer growth.

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**NBR: 207599** **ACRONYM: COSPSENA** **EC FUND: 1377000**

**DG:** ERCEA **Call: ERC-2007-StG** **Thema:** ERC-SG-PE3

**Title:** Coherence of Spins in Semiconductor Nanostructures

**Abstract:** Macroscopic control of quantum states is a major theme in much of modern physics because quantum coherence enables study of fundamental physics and has promising applications for quantum information processing. The potential significance of quantum computing is recognized well beyond the physics community. For electron spins in GaAs quantum dots, it has become clear that decoherence caused by interactions with the nuclear spins is a major challenge. We propose to investigate and reduce hyperfine induced decoherence with two complementary approaches: nuclear spin state narrowing and nuclear spin polarization. We propose a new projective state narrowing technique: a large, Coulomb blockaded dot measures the qubit nuclear ensemble, resulting in enhanced spin coherence times. Further, mediated by an interacting 2D electron gas via hyperfine interaction, a low temperature nuclear ferromagnetic spin state was predicted, which we propose to investigate using a quantum point contact as a nuclear polarization detector. Estimates indicate that the nuclear ferromagnetic transition occurs in the sub-Millikelvin range, well below already hard to reach temperatures around 10 mK. However, the exciting combination of interacting electron and nuclear spin physics as well as applications in spin qubits give ample incentive to strive for sub-Millikelvin temperatures in nanostructures. We propose to build a novel type of nuclear demagnetization refrigerator aiming to reach electron temperatures of 0.1 mK in semiconductor nanostructures. This interdisciplinary project combines Microkelvin and nanophysics, going well beyond the status quo. It is a challenging project that could be the beginning of a new era of coherent spin physics with unprecedented quantum control. This project requires a several year commitment and a team of two graduate students plus one postdoctoral fellow.

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**NBR: 207810** **ACRONYM: FLEXPAKRENEW** **EC FUND: 3276000**

**DG:** RTD **Call: FP7-NMP-2007-SMALL-1** **Thema:** NMP-2007-2.4-3

**Title:** Design and development of an innovative ecoefficient low-substrate flexible paper packaging from renewable resources to replace petroleum based barrier films.

**Abstract:** The objective of this project is to design and to develop an innovative ecoefficient low-substrate flexible paper for packaging from renewable resources to reduce the packaging industry's reliance on barrier films derived from petroleum. The challenge of this project is to develop a flexible packaging paper, with barrier properties (grease, water, oxygen and water vapour barrier) competitive with those of untreated plastic films (medium barrier) or to treated plastic films (high barrier). This paper will be developed using renewable materials, beyond state-of-the-art barrier coatings and innovative surface treatment processes. The main scientific advances concern: 1-The development of a substrate with significantly enhanced barrier properties via knowledge-led improvement and innovation such as the use of selected materials in the bulk and the deposition of a thin film of renewable materials during the paper forming. 2-Development of water borne coatings made from renewable materials (starches, functionalised starches, starch derivatives or modified hemicelluloses) and reinforced by (low eco-footprint) minerals or renewable nanoparticles to optimise the desired properties. 3-Development of high barrier paper arising from innovative surface treatments: Solvent free chemical grafting and vacuum coating. These two techniques, although based on very different principles, enable the deposition of nanolayers (a few molecular layers) that drastically improve the barrier properties. 4-Development of a new type of antibacterial coatings to prolong food quality. Particular attention will be paid to sustainability assessment and life cycle analysis throughout the project. A substantial reduction in the amount of packaging going to landfill is envisaged, together with speedier environmental degradation of the packaging materials. This project will make a significant contribution to reduce the reliance on petroleum resources during packaging production.

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**NBR: 208319** **ACRONYM: FORCEMAP** **EC FUND: 750000**

**DG:** ERCEA **Call: ERC-2007-StG** **Thema:** ERC-SG-LS1

**Title:** Intramolecular force mapping of enzymes in action: the role of strain in motor mechanisms

**Abstract:** A fundamental but unexplored problem in biology is whether and how enzymes use mechanical strain during their functioning. It is now evident that the knowledge of atomic structures and chemical interactions is not sufficient to understand the intricate mechanisms underlying enzyme specificity and efficiency. Several lines of evidence suggest that mechanical effects play crucial roles in enzyme activity. Therefore we aim to create detailed force maps that reveal how the intramolecular distribution of

mechanical strains changes during the enzyme cycle and how these rearrangements drive the enzyme processes. The applicability of current nanotechniques for the investigation of this problem is limited because they do not allow simultaneous measurement of mechanical and enzymatic parameters. Thus we seek to open new avenues of research by developing site-specific sensors and passive or photoinducible molecular springs to measure force-dependent chemical/structural changes with high spatiotemporal resolution in myosin. Since force perturbations occur very rapidly, we are able to combine experimental studies with quasi-realistic in silico simulations to describe the physical background of enzyme function. We expect that our research will yield fundamental insights into the role of intramolecular strains in enzymes and thus greatly aid the design and control of enzyme processes (specificity, activity, regulation). Our studies may also lead to new paradigms in the understanding of motor systems.

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**NBR: 208702** **ACRONYM: COMMOTION** **EC FUND: 1250000**

**DG:** ERCEA **Call: ERC-2007-StG** **Thema:** ERC-SG-PE4

**Title:** Communication between Functional Molecules using Photocontrolled Ions

**Abstract:** The goal of COMMOTION is to establish a strategy whereby functional molecular devices (e.g. photo-/electroactive) can communicate with one another in solution and in organized, self-assembled media (biotic and abiotic). Despite intense research, no single strategy has been shown to satisfactorily connect artificial molecular components in networks. This is perhaps the greatest hurdle to overcome if implementation of artificial molecular devices and sophisticated molecule-based arrays are to become a reality. In this project, communication between distant sites / molecules will be based on the use of photoejected ions in solution and organized media (membranes, thin films, nanostructured hosts, micellar nanodomains). Ultimately this will lead to coded information transfer through ion movement, signalled by fluorescent reporter groups and induced by photomodulated receptor groups in small photoactive molecules. Integrated photonic and ionic processes operate efficiently in the biological world for the transfer of information and multiplexing distinct functional systems. Application in small artificial systems, combining “light-in, ion-out” (photoejection of an ion) and “ion-in, light-out” processes (ion-induced fluorescence), has great potential in a bottom-up approach to nanoscopic components and sensors and understanding and implementing logic operations in biological systems. Fast processes of photoejection and migration of ions will be studied in real-time (using time-resolved photophysical techniques) with high spatial resolution (using fluorescence confocal microscopy techniques) allowing evaluation of the versatility of this strategy in the treatment and transfer of information and incorporation into devices. Additionally, an understanding of the fundamental events implicated during the process of photoejection / decomplexion of coordinated ions and ion-exchange processes at membrane surfaces will be obtained.

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**NBR: 208792** **ACRONYM: 3D-FM** **EC FUND: 1794960**

**DG:** ERCEA **Call: ERC-2007-StG** **Thema:** ERC-SG-PE3

**Title:** Taking Force Microscopy into the Third Dimension

**Abstract:** I propose to pursue two emerging Force Microscopy techniques that allow measuring structural properties below the surface of the specimen. Whereas Force Microscopy (most commonly known under the name AFM) is usually limited to measuring the surface topography and surface properties of a specimen, I will demonstrate that Force Microscopy can achieve true 3D images of the structure of the cell nucleus. In Ultrasound Force Microscopy, an ultrasound wave is launched from below towards the surface of the specimen. After the sound waves interact with structures beneath the surface of the specimen, the local variations in the amplitude and phase shift of the ultrasonic surface motion is collected by the Force Microscopy tip. Previously, measured 2D maps of the surface response have shown that the surface response is sensitive to structures below the surface. In this project I will employ miniature AFM cantilevers and nanotube tips that I have already developed in my lab. This will allow me to quickly acquire many such 2D maps at a much wider range of ultrasound frequencies and from these 2D maps calculate the full 3D structure below the surface. I expect this technique to have a resolving power better than 10 nm in three dimensions as far as 2 microns below the surface. In parallel I will introduce a major improvement to a technique based on Nuclear Magnetic Resonance (NMR). Magnetic Resonance Force Microscopy measures the interaction of a rotating nuclear spin in the field gradient of a magnetic Force Microscopy tip. However, these forces are so small that they pose an enormous challenge. Miniature cantilevers and nanotube tips, in combination with additional innovations in the detection of the cantilever motion, can overcome this problem. I expect to be able to measure the combined signal of 100 proton spins or fewer, which will allow me to measure proton densities with a resolution of 5 nm, but possibly even with atomic resolution.

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**NBR: 208858** **ACRONYM: UMDNAS** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2007-4-3-IRG** **Thema:** PEOPLE-2007-4-3.IRG

**Title:** Understanding materials and devices at the nanoscale using atomistic simulations

**Abstract:** An atomic- or electronic-level description of matter will be used as the basis for computer simulations of materials and devices. A variety of problems near the intersection of physics, chemistry, biology, engineering, and materials science will be

studied with the overall goal of exploring the physical properties of materials and devices and providing detailed information on these properties that is not accessible experimentally. This project will provide the understanding and quantitative information that is necessary to improve the efficiencies of existing materials synthesis techniques and it will uncover new properties of materials that, inevitably, will be exploited in technological applications. Topics that will be studied include the structure and dynamics of silicate liquids and glasses, the performance, efficiency, and underlying thermodynamic principles of artificial and naturally-occurring nanomachines, and the structures, growth, and physical properties of nanostructured materials. While much can be learned using existing simulation techniques, there is much room for improvement of the accuracy of large-scale atomistic simulations of semiconducting materials. A goal of this project will be to develop new accurate force-fields for materials such as silicon, GaAs, and CdSe so that reliable simulations can be performed of the growth and assembly of clusters, nanocrystals, and nanorods. These simulations will be used to provide a better understanding of the relationships between the structures and physical properties of materials.

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**NBR: 208948** **ACRONYM: NANOPOTS** **EC FUND: 1799964**

**DG:** ERCEA **Call: ERC-2007-StG** **Thema:** ERC-SG-PE6

**Title:** Nanotube Based Polymer Optoelectronics

**Abstract:** The target of this project is to develop a new class of polymer based optoelectronic devices embedding the optical and electronic functionalities of carbon nanotubes (CNTs). These devices will combine the fabrication advantages of polymer photonics, with the tunable active and passive optical properties of CNTs. This is an ambitious frontier research program, with a strong interdisciplinary nature, across engineering, physical, chemical and soft matter sciences. The ERC grant will consolidate the newly funded Research Group lead by the PI at the newly built centre for Advanced Photonics and Electronics of the University of Cambridge. CNTs will be grown by chemical vapour deposition at low temperatures, compatible with polymer processing. Direct deposition of CNT on optical components (such as fibres and mirrors) will be studied. Fundamental understanding of ultra-fast non-linear optics will be sought by a combination of theory and experiments. A range of novel photonic polymers incorporating CNTs will be produced: index matching gels, optical adhesives and silicones. These new materials, incorporating the optical functionality of CNTs, will be used to build a variety of photonic devices. Nanowires are also promising for photonic applications, since they exhibit a size-tunable absorption resonance at telecommunications wavelengths, and their use will also be considered.

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**NBR: 209241** **ACRONYM: BIOMOFS** **EC FUND: 1250000**

**DG:** ERCEA **Call: ERC-2007-StG** **Thema:** ERC-SG-PE4

**Title:** Bioapplications of Metal Organic Frameworks

**Abstract:** This project will focus on the use of nanoporous metal organic frameworks (Fe, Zn, Ti) for bioapplications. These systems are exciting porous solids, built up from inorganic clusters and polycarboxylates. This results in open-framework solids with different pore shapes and dimensions, and applications such as catalysis, separation and storage of gases. I have recently initiated the synthesis of new trivalent transition metal carboxylates. Among them, the metal carboxylates MIL-100 and MIL-101 (MIL: Materials of Institut Lavoisier) are spectacular solids with giant pores (25-34 Å), accessible metal sites and huge surface areas (3100-5900 m2.g-1). Recently, it was shown that these solids could be used for drug delivery with a loading of 1.4 g of Ibuprofen per gram of MIL-101 solid and a total release in six days. This project will concentrate on the implication of MOFs for drug release and other bioapplications. Whereas research on drug delivery is currently focused either on the use of bio-compatible polymers or mesoporous materials, our method will combine advantages of both routes including a high loading and a slow release of therapeutic molecules. A second application will use solids with accessible metal sites to coordinate NO for its controlled delivery. This would provide exogenous NO for prophylactic and therapeutic processes, anti-thrombogenic medical devices, improved dressings for wounds and ulcers, and the treatment of fungal and bacterial infections. Finally, other applications will be envisaged such as the purification of physiological fluids. The project, which will consist of a systematic study of the relation between these properties and both the composition and structure of the hybrid solids, will be assisted by a strong modelling effort including top of the art computational methods (QSAR and QSPKR). This highly impact project will be realised by assembling experienced researchers in multidisplinary areas including materials science, biology and modelling. It will involve P. Horcajada (Institut Lavoisier), whose background in pharmaceutical science will fit with my experience in inorganic chemistry and G. Maurin (Institut Gerhardt, Montpellier) expert in computational chemistry.

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**NBR: 209481** **ACRONYM: ZEOCELL** **EC FUND: 1917401**

**DG:** RTD **Call: FP7-ENERGY-2007-1-RTD** **Thema:** ENERGY-2007-1.1-01

**Title:** NANOSTRUCTURED ELECTROLYTE MEMBRANES BASED ON POLYMER-IONIC LIQUIDS-ZEOLITE COMPOSITES FOR HIGH TEMPERATURE PEM FUEL CELL

**Abstract:** The PEMFC represents one of the most promising technologies in the field of fuel cells. One of the keys to the success of the PEMFC technology is the development of improved

electrolyte membrane materials which can be produced in mass and can operate within a temperature range of 130-200ºC. The ZEOCELL project will develop a nanostructured electrolyte membrane based on a new composite multifunctional material consisting of the combination of 3 materials: zeolites, ionic liquids and polymers – integrating their beneficial characteristics. The membrane will have an innovative structure comprising a 2D polymer matrix and two zeolite layers, with the following properties: - High ionic conductivity: ≥100 mS/cm at 150ºC.; - Suitability for operating at temperatures between 130-200ºC; - Good chemical, mechanical and thermal stability up to 200ºC; - Durability (< 400 EUR/m2). Expert researchers and industries with high technological capacities and potential market make up the project consortium. Their expertise will be: Researchers: INA (small pore of zeolites and membrane development). FORTH/ICE-HT (large pore of zeolites and modeling membrane conduction performance). CIDETEC: (resistant polymer materials, 2D random nanoporous polymer structures and membrane characterization in H2-PEMFC and DAFC). UTWENTE (PBI and PEEK type polymers). CFR-FIAT (2D microstructured polymeric matrix with ordered nanoporous). Industries: SOLVIONIC (Ionic Liquids). SOLVAY (integration of conducting polymers in the nanostructured membranes and characterization of them on single fuel cells). CEGASA (analysis of the suitability for mass-production of the new membrane).

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**NBR: 209578** **ACRONYM: NANOPHOTONIC DEVICES** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2007-4-3-IRG** **Thema:** PEOPLE-2007-4-3.IRG

**Title:** Physics and applications of nanocrystal - polymer nanophotonic devices

**Abstract:** We propose the fabrication and optical study of new nanophotonic devices based on composite, highly transparent polymer matrices that incorporate near infrared, light emitting semiconductor nanocrystal quantum dots, on different sub-micron patterned surfaces. The devices will combine the atomic-like optical functionality of the nanocrystal quantum dots and the fabrication flexibility of the polymer host with state-of-the-art Si based and Metallic based nanophotonic platforms, such as sub-micron size Si core and air core waveguides and resonators, and sub-wavelength resonant metallic gratings. The proposed objectives are: (a) Understanding the physical mechanisms that determines the carrier dynamics in those nanocrystal quantum dots and in the nanocrystal-polymer composite. (b) A design, fabrication, and study of new active (light emitting) devices and passive nonlinear devices that are based on such hybrid nanocrystal-polymer matrices on Si based planar nano-patterned waveguide platforms. (c) Fabrication and study of nanocrystal-polymer composites incorporated into subwavelength metallic structures, to understand the coupling of the different types of resonant plasmon modes of the subwavelength metallic structure to the nanocrystal quantum dots, probe the enhanced local fields effect on the linear and nonlinear optical properties of the active composite, and identify the potential of such structures as new photonic devices. The experimental methods will include continuous wave as well as

time resolved optical spectroscopy, and high-power ultrafast two beam and three beam pump-probe measurements.

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**NBR: 209636** **ACRONYM: PLACQED** **EC FUND: 1712342**

**DG:** ERCEA **Call: ERC-2007-StG** **Thema:** ERC-SG-PE3

**Title:** Plasmonic cavity quantum electrodynamics with diamond-based quantum systems

**Abstract:** This proposal aims to realize physical systems for the realization of plasmonic cavity quantum electrodynamics using optically active diamond-based quantum systems such as atomic impurities. Color centers in diamond provide a suitable test bed for applications of quantum information processing, as well as selected spin-spin interactions. While there are hundreds of known color centers in diamond, but only one (Nitrogen vacancy) is studied extensively. We will study optical properties and identify energy levels of alternative color centers both naturally occurring and artificially implanted, potential candidates being Ni, Si, or Fe impurities. We will in parallel study solid-state-based cavity QED with light confinement at sub-wavelength scale. Using metal nanostructures and plasmons, we aim at achieving individual or ensemble strongly coupled emitter-cavity systems. Further, we will study how sub-wavelength structures of a medium alter the material-based properties, so the optical fields can experience exotic media with negative refractive indices.

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**NBR: 209825** **ACRONYM: ERIKLINDAHLERC2007** **EC FUND: 992413**

**DG:** ERCEA **Call: ERC-2007-StG** **Thema:** ERC-SG-PE4

**Title:** Multiscale and Distributed Computing Algorithms for Biomolecular Simulation and Efficient Free Energy Calculations

**Abstract:** The long-term goal of our research is to advance the state-of-the-art in molecular simulation algorithms by 4-5 orders of magnitude, particularly in the context of the GROMACS software we are developing. This is an immense challenge, but with huge potential rewards: it will be an amazing virtual microscope for basic chemistry, polymer and material science research; it could help us understand the molecular basis of diseases such as Creutzfeldt-Jacob, and it would enable rational design rather than random screening for future drugs. To realize it, we will focus on four critical topics: • ALGORITHMS FOR SIMULATION ON GRAPHICS AND OTHER STREAMING PROCESSORS: Graphics cards and the test Intel 80-core chip are not only the most powerful processors available, but this type of streaming architectures will power many supercomputers in 3-5 years, and it is thus critical that we design new “streamable” MD algorithms. •

MULTISCALE MODELING: We will develop virtual-site-based methods to bridge atomic and mesoscopic dynamics, QM/MM, and mixed explicit/implicit solvent models with water layers around macromolecules. • MULTI-LEVEL PARALLEL & DISTRIBUTED SIMULATION: Distributed computing provides virtually infinite computer power, but has been limited to small systems. We will address this by combining SMP parallelization and Markov State Models that partition phase space into transition/local dynamics to enable distributed simulation of arbitrary systems. • EFFICIENT FREE ENERGY CALCULATIONS: We will design algorithms for multi-conformational parallel sampling, implement Bennett Acceptance Ratios in Gromacs, correction terms for PME lattice sums, and combine standard force fields with polarization/multipoles, e.g. Amoeba. We have a very strong track record of converting methodological advances into applications, and the results will have impact on a wide range of fields from biomolecules and polymer science through material simulations and nanotechnology.

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**NBR: 210037** **ACRONYM: WOODY** **EC FUND: 5099238**

**DG:** RTD **Call: FP7-NMP-2007-LARGE-1** **Thema:** NMP-2007-4.0-1

**Title:** Innovative advanced Wood-based Composite Materials and Components

**Abstract:** Currently the world of polymeric composite materials is almost exclusively based on fossil derived components. This fact represents a strong issue, as the non-renewable global oil resources are being exploited year after year, also as a consequence of the ever growing demand for plastics engineering materials. WOODY Project goal is to develop new composite panels and laminates from wood derived renewable materials, providing performances competitive with respect to traditional composites. WOODY Project is aimed at introducing a fully innovative paradigm in the composite industry, thanks to development of materials derived from natural resources, enabling to cover the whole necessities of components: fibre, matrix and core. Enzymatic processing is developed in parallel to chemo-thermo-mechanical treatments, for achieving the maximum throughput and eco-sustainability. The breakthrough innovation in materials is backed by an innovative approach in design of composite products, the so called "Composite Thinking", starting from the phase of conception, to the production and installation, enabling to rethink products and fully exploiting the potentialities of composites. Quality of the approach is based on multidisciplinary research and on the target oriented to the redefinition of the whole processing value-chain for wood derived cellulose nano fibrils and resins deriving from natural raw materials, and the related manufacturing processes for advanced composite components. The Project is aimed to set the basis for the development of a new class of products optimising the use of the natural resources. Such approach is therefore expected to increase the tendency for wild forest areas recovery, and to promote the culture of wooden species dedicated to the extraction of compounds finalized to the production of renewable composite materials.

**NBR: 210078** **ACRONYM: SMART** **EC FUND: 1500000**

**DG:** ERCEA **Call: ERC-2007-StG** **Thema:** ERC-SG-PE6

**Title:** Scanning Microscopy using Active Resonating nanoTips

**Abstract:** This SMART application proposes a technological breakthrough in the field of Atomic Force Microscopy (AFM). It aims at introducing Micro/Nano Electromechanical Systems (MNEMS) as a new generation of AFM probes having outstanding performances in terms of sensitivity and acquisition rate. More precisely, we aim at using bulk mode microresonators to drive an oscillating nanotip in the GHz range. Many applications are expected in the emerging fields of nanobiosciences. AFM systems have been widely used for 20 years in academic and industrial work. They give access to microscopy images at the nanoscale and derived techniques allow many physical characterizations. Many labs are currently trying to use the oscillating mode of AFM to probe biological nanosystems and their dynamics in a liquid environment. However, AFM performances are limited by the AFM oscillator itself. It is typically made of a tip supported by a cantilever beam whose oscillating properties are drastically degraded once placed in a liquid. This phenomenon is due to the hydrodynamic drag and the added mass of the liquid. Consequently, the resonant frequencies and quality factors are too low in liquids to support the force sensitivity and acquisition rate required to probe biological nanosystems dynamics. The SMART project proposes to change the overall AFM oscillator and to choose an oscillation mode in the GHz range that reduces the liquid velocity gradient around the resonator. This new generation of high sensitivity AFM force sensor will be an unprecedented tool for imaging biological and chemical systems at the nanoscale and the possibility of kinetic spectroscopy in liquids. AFM performances are expected to be increased by 3 orders of magnitude. The SMART investigator has a 10 year background in AFM and a 7 year experience in MNEMS resonators. Today, there is no project strictly similar to this one at international level. If successful, Europe could become a leader in this high level competition.

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**NBR: 210092** **ACRONYM: NANOHY** **EC FUND: 2399629**

**DG:** RTD **Call: FP7-ENERGY-2007-1-RTD** **Thema:** ENERGY-2007-1.2-04

**Title:** Novel Nanocomposites for Hydrogen Storage Applications

**Abstract:** In order to meet the international goals for hydrogen storage materials, the work in NANOHy aims at combining the latest developments in the metal hydride field with novel concepts for tailoring materials properties. Leading expertise in the field of

complex hydride synthesis, synthesis and functionalization of nanostructured carbon, nanoparticle coating, structural characterization, and computational methods will be joined to achieve a fundamental understanding combined with considerable practical progress in the development of novel nanostructured materials for hydrogen storage. The target materials are nanocomposites consisting of hydride particle sizes in the lower nanometer range which are protected by a nanocarbon template or by self-assembled polymer layers in order to prevent agglomeration. Thus, there is potential to lower working temperature and pressure, to enhance the reversibility, and to control the interaction between the hydride and the environment, leading to improved safety properties. Materials of this kind can mitigate or solve principal and practical problems which have been identified recently in other projects. The composites will be synthesized out of novel complex hydrides with very high hydrogen content and nanocarbon templates. Alternatively, hydride colloids will be coated in a Layer-by-Layer self-assembling process of dedicated polymers. Computational methods will be used to model the systems and predict optimal materials/size combinations for improved working parameters of the systems. Sophisticated instrumental analysis methods will be applied to elucidate the structure and the properties of the nano-confined hydrides. An upscale of the target nanocomposite will be made in the final stage and 0.5-1 kg of the material will be integrated and tested in a specially designed laboratory tank. Techno-economical evaluation will be performed and potential spin-off applications will be explored by an industry partner in NANOHy.

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**NBR: 210642** **ACRONYM: OPTNANO** **EC FUND: 1097820**

**DG:** ERCEA **Call: ERC-2007-StG** **Thema:** ERC-SG-PE3

**Title:** Quantum optics in nanostructures

**Abstract:** Nanomaterials are intriguing structures for quantum optics. Their color depends on their size and shape; they are very selective in the wavelengths they absorb and emit. Although nanostructures have been used to color windows and surfaces since the Middle Ages, we lack the understanding how size, shape, and microscopic structure control the optical properties of nanomaterials. In this project, we plan to develop a fundamental description of quantum optics in one-dimensional nanosystems. Core concepts will be quantum confinement and electron interactions when carriers are forced into a small space. The proposed work will focus on carbon nanotubes as a model nanosystem. The tubes show pronounced confinement effects; they emit and absorb light in the near infrared and visible. We will measure optical transitions, quantum cross sections, and electron interaction using luminescence, Raman scattering, and photoconductivity. The optical properties will be tailored by selecting specific tube types and changing the tube environment. A description of optical processes is incomplete without considering defects in real nanostructures. We will develop techniques to study and introduce imperfections. Their optical signatures and their effect on light emission

will be determined on individual tubes. The experiments will be complemented by materials modeling. We will describe confinement effects and Coulomb interaction in semiempirical calculations of nanotube light absorption. The knowledge gained on carbon nanotubes will be applied to predict and study the optical properties of other one-dimensional systems. The goal is to obtain a robust and transferable model of quantum optics in nanostructures. This project will also advance characterization of nanomaterials by optical spectroscopy and applications of nanotubes as light detectors and emitters. We plan to develop tools for nanotube population analysis (tube type) and to test carbon tubes as wavelength-selective photodetectors

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**NBR: 210947** **ACRONYM: NANOTUBEMEM** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2007-4-3-IRG** **Thema:** PEOPLE-2007-4-3.IRG

**Title:** Carbon NANOTUBE MEMbranes by Templated Growth in Oriented Molecular Sieve Films

**Abstract:** Recently, carbon nanotube membranes attracted attention because of experiments and simulations indicating extremely high fluxes. If selective separations can also be demonstrated, these membranes will be a major breakthrough in efficient gas, liquid and vapor separations with tremendous implications in energy efficiency, especially in hydrocarbon separations, water purification and microdevices for hydrogen purification and storage. The currently used multi-step microfabrication procedures, although appropriate for laboratory scale measurements, do not allow for efficient and economic production of the large membrane areas (e.g., hundred square meters) needed for membrane based purification applications nor they provide means for precisely controlling nanotube size and structure that may be desirable for highly selective separations. We propose to undertake the challenge to develop practical selective nanotube membranes by growing submicron thick, densely-packed, subnanometer diameter carbon nanotubes in the interior of the pores of oriented aluminophoshate (AlPO4) molecular sieve films. The proposed use of AlPO4 films as hosts of carbon nanotubes is motivated by previous studies that demonstrate carbon nanotube synthesis inside the micropores of AlPO4 crystalline powders and builds on our ability to grow well-intergrown and appropriately oriented AlPO4 films. If successful, we expect to form high concentration of oriented and uniformly sized carbon nanotubes extending throughout the molecular sieve channels. It is possible that membranes with unprecedented performance (high selectivity and extremely high flux) will be the ultimate outcome of this work. Moreover, the growth technique that we propose to develop and the resulting oriented carbon nanotube films may be of interest for electronic and electrochemical applications.

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**NBR: 211166** **ACRONYM: MINATRAN** **EC FUND: 1128400**

**DG:** ERCEA **Call: ERC-2007-StG** **Thema:** ERC-SG-PE6

**Title:** Probing the Micro-Nano Transition: Theoretical and Experimental Foundations, Simulations and Applications

**Abstract:** The objective is to develop a robust multifunctional framework/probe for capturing the evolution of deformation and failure in a variety of processes at the micro-nano transition regime. An interdisciplinary approach will be pursued based on fundamental theory and experiment, in conjunction with multiscale simulations for micro/nanotechnology applications. The approach is unconventional as it ventures to extend continuum mechanics down to the micro/nano regime and verify this through nanoindentation and atomic force microscopy techniques. It is also unique as the new phenomenology introduced for establishing this extension (higher order gradients accounting for microscopic processes and interfacial energy terms accounting for nanoscopic phenomena) will be substantiated through hybrid (ab initio-atomistic-defect-finite element) simulations. The framework will be employed to consider fracture and size effects in a number of micro-nano scale transition configurations ranging from nanograined aggregates and nanolayered structures to multiwalled nanotubes and ropes, and from Li-ion battery electrodes to bioactive bone-metal interfaces. Other micro/nano objects such as quantum dots, nanowires and NEMS/MEMS devices, as well as biomolecular microcrystalline membranes leading to living cell division will be considered. In a sense this “scale” transition theory is reminiscent in scope to Landau’s “phase” transition theory where a variety of different physical phenomena can be treated within a common framework. This optimism stems from the PI’s previous success with this approach, as well as Smalley’s remark that the “laws of continuum mechanics are amazingly robust for treating even intrinsically discrete objects only a few atoms in diameter”. A good mix of young researchers and mature scholars will be employed, thus connecting people and ideas through joint publications and scholarly activities in a critical area of fundamental and applied research.

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**NBR: 211284** **ACRONYM: MOLSPINQIP** **EC FUND: 2007999**

**DG:** CNECT **Call: FP7-ICT-2007-C** **Thema:** ICT-2007.8.0

**Title:** Molecular Spin Clusters for Quantum Information Processing

**Abstract:** Molecular spin clusters are prototypical systems exhibiting coherent dynamics of the electronic spin. The pattern of the lowest lying spin states is well defined and controlled at the synthetic level. The chemical bottom up approach used for the synthesis of molecules also allows to reduce intrinsic sources of decoherence and to build links between clusters, thus creating entanglement of spin states. Molecular spin clusters can be deposited at surfaces forming scalable networks. Different molecules and ligands

may be combined to exploit different functionalities, the latter being defined at molecular level. These facts provide extraordinary motivation to attempt manipulation of spins and qubit encoding in these nanometer-sized molecular processors that, in turns, can be taken as test bench for the development of novel quantum algorithms. With MolSpinQIP we intend to prove the validity of molecular spin clusters as building blocks for scalable quantum-information architectures. The project will therefore focus on the engineering of new molecules, the design of suitable computational schemes and further experiments aiming at provide compelling evidences on the manipulation of molecular spins. To achieve its goals, MolSpinQIP brings together seven academic world-leading teams from five European countries, chosen because of their high scientific quality and track record of successful collaboration. The competencies of the team range from chemistry to experimental and theoretical physics. The goal of implementing quantum information processes is certainly ambitious but molecular spin clusters have a great potential both as a self-standing quantum device and as components of hybrid architectures. We also expect important fall out in testing novel synthetic routes to fabricate molecular processors/registers and in the realization of novel detectors that will certainly lead to significant progress in probing vanishingly small magnetic registers.

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**NBR: 211329** **ACRONYM: PARTICOAT** **EC FUND: 4800000**

**DG:** RTD **Call: FP7-NMP-2007-LARGE-1** **Thema:** NMP-2007-2.5-1

**Title:** New multipurpose coating systems based on novel particle technology for extreme environments at high temperatures

**Abstract:** The overall objective of the project is to develop a novel, unconventional and cost efficient type of multipurpose high temperature coating systems on the basis of property tailoring by particle size processing of metallic source materials. It shall possess multi-functionality that will comprise thermal barrier effect, oxidation and corrosion protection, lotus effect, electrical insulation at elevated temperatures and fire protection. The concept of the novel approach to protection of surfaces is a coating consisting in its initial state of nano- and/or micro-scaled metal particles with a defined size, deposited by spraying, brushing, dipping or sol-gel. During the heat treatment, the binder is expelled, bonding to the substrate surface achieved, the metallic particles sinter and oxidise completely resulting in hollow oxide spheres that form a quasi-foam structure. Simultaneously, a diffusion layer is formed below the coating serving as a corrosion protection layer and as a bond coat for the top layer. The structure of the coating system shall be adjusted by parameters like selection of source metal/alloy, particle size, substrate, binder and a defined heat treatment. For fire protection the formation of hollow oxide spheres will be processed in a separate step before deposition. The flexibility of the new coatings integrates a wide field of application areas, such as gas and steam turbines in electric power generation and aero-engines, combustion chambers, boilers, steam generators and super-heaters, waste incineration,

fire protection of composite materials in construction as well as reactors in chemical and petrochemical industry. A broad impact will thus be ensured increasing safety and the durability of components by an economic, multifunctional and flexible protection of their surfaces. The novelty will provide a real step change in the understanding of materials degradation mechanisms in extreme environments.

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**NBR: 211335** **ACRONYM: MICROFLEX** **EC FUND: 5429450**

**DG:** RTD **Call: FP7-NMP-2007-LARGE-1** **Thema:** NMP-2007-3.5-2

**Title:** Micro fabrication production technology for MEMS on new emerging smart textiles/flexibles

**Abstract:** This proposal concerns flexible materials in the form of high added value smart fabrics/textiles which are able to sense stimuli and react or adapt to them in a predetermined way. The challenge for the European textile industries is to add advanced functions to textiles and the recent progress of new technologies such as electronic inks provide an opportunity for a breakthrough by incorporating MEMS on flexible textiles/fabrics. The project will exploit microfabrication to produce, using custom printing processes, active functions cost efficiently. We propose to develop fundamental micro fabrication production technologies for MEMS on fabrics/textiles using flagship demonstrator applications. This will result in a cheap, easy to design, flexible, rapid, way to manufacture multifunction smart textiles/garments for a large set of multi-sectorial applications. The processes will be based on thick film printing and sacrificial etching for the MEMS structures. Subsequent inkjet printing will be used to deposit thinner structures on the thick film printed layers incorporating for example active nanoparticles to add further functionality. These printing processes have many benefits including low-cost, repeatability, flexibility, suitability for high throughput production, relatively inexpensive equipment, short development time and the capability of depositing a wide range of materials. All the novel printed inks will be electrically activated sensors and actuators and we will use standard electronic devices for power supply/storage, signal processing and communications offering low price and mass production. The project will undertake a number of initial demonstrators of the underlying basic technology. These will be based on: light emission, cooling/heating, anti-static effect, energy harvesting, micro-encapsulation and actuation. MICROFLEX is a perfect example of the transformation of a resource-intensive to a knowledge-intensive industry.

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**NBR: 211383** **ACRONYM: NANO-MUBIOP** **EC FUND: 2512150**

**DG:** RTD **Call: FP7-NMP-2007-SMALL-1** **Thema:** NMP-2007-1.1-1

**Title:** Enhanced sensitivity Nanotechnology-based Multiplexed Bioassay Platform for diagnostic applications

**Abstract:** Currently, there is strong interest in the development of new bioassay techniques for gene identification, gene mapping, DNA sequencing and medical diagnostics. There are three main families of methods: Polymerase Chain Reaction, Enzyme-Linked Immunosorbent Assay and nano-particles agglutination techniques. All these methods suffer from several disadvantages as they are time-consuming and expensive, they are not quantitative and exclude multiplexing, i.e. the detection of different genotypes simultaneously. The need of a new multiplexing and quantitative bioassay technique is evident. The aim of this project is to develop a high sensitivity multiplexed platform based on a bio-non bio nanostructure able to enhance diagnostic capabilities by exploiting the dimensional shift from bio-systems to nanometric particles, thus overcoming many of the limitations of the existing methods. This method could be adapted to the detection of many kinds of bio-systems, but the project will focus on Human Papilloma Virus (HPV) responsible for cancer. The project idea is based on the development of nanoparticles functionalised with probes complementary to HPV DNA conservative region and an array of specific bio-probes for the different HPV genotypes deposited on a solid substrate. The nanoparticles will bind to the bio-system and then they will diffuse through the suspension docking to the area of the array where the probe specific for that genotype is coated. An array of nanoparticles will be created and the concentration of each HPV genotype can be quantified by estimating the number of particles bounded to each specific area. Considering the global worldwide market of the immune and genetic tests (20 Billion €) the potential economic impact can be up to 100 M€. Private/public national or local health service providers will get benefits from NANO-MUBIOP, the single test cost being about 4 € for the service provider. Last but not least, the costs will be reduced for the patients.

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**NBR: 211436** **ACRONYM: EMBEK1** **EC FUND: 2914466**

**DG:** RTD **Call: FP7-NMP-2007-SMALL-1** **Thema:** NMP-2007-1.1-1

**Title:** Development and analysis of polymer based multi-functional bactericidal materials

**Abstract:** 90% of bacteria are found attached to solid surfaces forming structures (bio-films), that are inaccessible to drugs and antibiotics. These bio-films represent a major problem in European society in both industry and health care. Currently, however, we understand little about how these bio-films form and, more importantly, how they can be prevented. This lack of understanding means that patients often suffer 'unnecessary' and painful infections following the formation of such films on surgical implants and catheters. With the growing problem of MRSA and C. difficile in hospitals, and the cost

of policing and hygiene measures, an understanding of how to prevent bacterial persistence in the hospital environment is critical to the sustainability of European healthcare. A multi-disciplinary group of European experts have the common aim to understand exactly how bacteria attach to, and persist on both biological and inert surfaces. We will use a range of biological and physio-chemical techniques to study several fundamental aspects of bacterial attachment. We will employ new molecular microbiology techniques to understand the genetic components governing the interaction of a bacterial biotic cell surface with the novel antimicrobial surfaces we create. Second, we will be using new nano-scale material science and physical chemistry techniques to create and understand these antimicrobial surfaces. This duel systems approach will allow us to theoretically model the processes of bacterial attachment and survival, which in turn will allow us to improve these surfaces in an iterative approach. We will generate intellectual property around the coatings and treatments used to derive the surfaces and develop these in collaboration with industry. The solutions will be designed specifically for the industrial partners participating in the project but can, with a minimum effort be adapted for applications in other areas through the iterative steps within the WPs.

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**NBR: 211464** **ACRONYM: NANODEVICE** **EC FUND: 9490888**

**DG:** RTD **Call: FP7-NMP-2007-LARGE-1** **Thema:** NMP-2007-1.3-1

**Title:** Novel Concepts, Methods, and Technologies for the Production of Portable, Easy-to-Use Devices for the Measurement and Analysis of Airborne Engineered Nanoparticles in Workplace Air

**Abstract:** Due to their unique properties, engineered nanoparticles (ENP) are now used for a myriad of novel applications with great economic and technological importance. However, some of these properties, especially their surface reactivity, have raised health concerns, which have prompted scientists, regulators, and industry to seek consensus protocols for the safe production and use of the different forms of ENP. There is currently a shortage of field-worthy, cost-effective ways - especially in real time - for reliable assessment of exposure levels to ENP in workplace air. In addition to the problems with the size distribution, a major uncertainty in the safety assessment of airborne ENP arises from the lack of knowledge of their physical and chemical properties, and the levels of exposure. A special challenge of ENP monitoring is to separate ubiquitous background nanoparticles from different sources from the ENP. Here the main project goal is to develop innovative concepts and reliable methods for characterizing ENP in workplace air with novel, portable and easy-to-use devices suitable for workplaces. Additional research objectives are (1) identification of relevant physico-chemical properties and metrics of airborne ENP; establishment of reference materials; (2) exploring the association between physico-chemical and toxicological properties of ENP; (3) analyzing industrial processes as a source of ENP in workplace air; (4)

developing methods for calibration and testing of the novel devices in real and simulated exposure situations; and (5) dissemination of the research results to promote the safe use of ENP through guidance, standards and education, implementing of safety objectives in ENP production and handling, and promotion of safety related collaborations through an international nanosafety platform.

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**NBR: 211473** **ACRONYM: PLASMANICE** **EC FUND: 4361650**

**DG:** RTD **Call: FP7-NMP-2007-LARGE-1** **Thema:** NMP-2007-1.2-1

**Title:** Atmospheric Plasmas for Nanoscale Industrial Surface Processing

**Abstract:** Atmospheric plasma techniques as processing methods have a number of advantages which include their ability to tailor the surface chemistry at the nanometre level. As such, the plasma treatments are energy efficient, reproducible and environmentally clean. In-line, continuous reel-to-reel processing equipment has been developed in the last 5 years. The wide scale application of this nano-processing technology in the pre-treatment of packaging materials in reel-to-reel processing has however been severely limited. One of the main reasons for this is the relatively slow processing velocity for coating depositions. In general, the velocities need to be increased by 2-5 fold in order to fully exploit the new nano-processing techniques. This proposal will address these issues in order to assist in the transfer of atmospheric plasma processing technology from the laboratory scale to industrial level in the packaging industry. Special attention will go out to the very promising combination with sol-gel technology. A method and equipment for in-line plasma deposition of high-barrier bio-based coatings to be applied in conjunction with extrusion coating at industrial line speeds will be developed. The approach will exploit sol-gel coatings applied on the substrates by plasma deposition. The substrates include paper, cardboard and plastic films. Renewable, biobased and biodegradable materials will be used as extrusion coatings. The project aims at replacement of fluoropolymer based grease barrier materials with sol-gel coated bioplastics and substitution of non-renewable barrier packaging films with renewables based materials in general. To achive these objectives, several leading European institutes and universities in atmospheric plasma deposition technology (VITO and TUE), sol-gel development (FhG-ISC and VTT) and extrusion coating and analytics development (TUT and JSI) together with a range of industrial participants are incorporated in the proposal.

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**NBR: 211536** **ACRONYM: MAMINA** **EC FUND: 3684044**

**DG:** REA **Call: FP7-PEOPLE-2007-1-1-ITN** **Thema:** PEOPLE-2007-1-1-ITN

**Title:** Macro, Micro and Nano Aspects of Machining

**Abstract:** The use of titanium, nickel-base, and cobalt-base alloys is necessary for the production of turbine parts and other components in the aerospace and the power generation industry due to their high strength even at elevated temperatures. On the other hand, these materials are known as the most difficult-to-machine metallic materials and so far, only small progress has been made to improve their machinability. During the production of turbine components up to 50% of the manufacturing costs can be related to machining. The reduction of the production costs by the optimization of the cutting process is mandatory for European manufacturers to remain internationally competitive. The MAMINA project will combine the work of 19 European universities, research institutions and industrial companies to analyse and improve the machinability of three selected alloys that are widely used in industry, namely Ti15V3Cr3Al3Sn, a titanium alloy, Inconel IN706, a nickel-base superalloy, and X40, a cobalt-base alloy. As the chip formation is one of the key factors influencing the machinability of these materials, this process will be studied in detail in a multidisciplinary approach. 24 ESR from the fields of theoretical physics, material science and mechanical engineering will be trained and work under the supervision of experienced scientists on cutting experiments, material analyses and simulations at the macro, micro- and nano-scale. Three different approaches will be made to improve the cutting process of the investigated alloys: 1. the introduction of enhanced manufacturing techniques, 2. the production of progressive tools with extended endurance, and 3. the development of free-machining alloys by the use of permanent and temporary alloying elements. The results will be transferred to applications by the industrial partners of the consortium. It is expected that the production costs during machining will be reduced up to 20%.

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**NBR: 211564** **ACRONYM: MNTEE** **EC FUND: 599627**

**DG:** RTD **Call: FP7-INFRASTRUCTURES-2007-1** **Thema:** INFRA-2007-3.0-06

**Title:** MNT Europe Extension

**Abstract:** The FP6/Infrastructure project MNT-Europe (RII3-CT-2004-506231) has led to the creation of a unique distributed platform for research and development in the field of Micro and Nano Technologies (MNT), based on the national facilities of Léti (F), CSEM (CH), IZM-M and IISB Fraunhofer (D), IMEC (B) and Tyndall (Ir) research institutes. The networking and Joint Research Activities performed during this project have highlighted the strengths and been able to pinpoint the remaining weaknesses of this Alliance. The basic idea of this proposal is to complete in the most efficient way this integration, based on the experience of this Alliance defined between major partners. Moreover, this will allow in a further step to aggregate new European R&D partners into a very robust core. Basically, three main activities will be dealt with: - a) global management of technical, strategic and commercial joint activities, with both consolidation of common

strategy and growth (based on expertise from mixed groups of technical experts, managers and commercial people), and the refinement in the coordination of operation plans (and a two step strategy with respect to the industrial world and the academic one, in view of future international access activities). - b) developing exploitation of the platform for preparing access to external further partners: this action will deal with solving interoperability problems which occurred during the MNT Europe project, mainly due to the difference in wafers size in use at the different institutes. In order to be able to handle future open access, a central contact point should be created, which allows all partners in the project to access and distribute all incoming contacts. - c) optimization of internal exchange/operation: this theme will mainly focus on improvement of the information exchange, refinement of common technologies roadmaps and new services on the MNT Europe website.

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**NBR: 211638** **ACRONYM: SYMBIOSIS-EU** **EC FUND: 2280098**

**DG:** RTD **Call: FP7-KBBE-2007-1** **Thema:** KBBE-2007-2-5-02

**Title:** Scientific sYnergisM of nano-Bio-Info-cOgni Science for an Integrated system to monitor meat quality and Safety during production, storage, and distribution in EU

**Abstract:** The SYMBIOSIS-EU project will bring together 14 partners from 6 EU countries (plus one each from NZ and US) to study meat safety & quality. The overall aim is to identify and quantitatively evaluate practical and easy to use chemical, biochemical and molecular indices and establish their applicability as quality monitors for inspection of meat safety and quality. The project will apply a multidisciplinary system-wide approach relying on converging technologies (bioinformatics, nanotechnology, modelling) to obtain knowledge for meat safety that will be translated into simple devices and practical indicators of quality and safety. The main objectives are (i) to develop and/or validate easy to use chemical/biochemical methods (e.g. biosensors, fluorescence, FT-IR), molecular methods (DNA microarrays), (ii) to develop a suitable software platform for data sharing and integration, (iii) to apply multivariate statistical methods and machine learning (neural networks, fuzzy logic, genetic algorithms) to identify robust multiple compound quality indices, (iv) integration of the sensors and information platform and development of a system to automatically transform data acquired from a sample into a “diagnosis” of meat safety and quality. The project plan designed to meet these objectives comprises 3 Sections: 1 Microbial status and their major metabolomic, molecular profiling of spoilage bacteria, 2. Development of an easy to use integrated system to monitor meat safety and quality 3. Development of protocols for simple, effective and cheap evaluation of meat quality and safety in industry, based on new indices of quality and safety relying on detection of metabolites by simple sensors, driven by user friendly software that facilitates practical use of the developed methods. The project will be of benefit to the EU meat industry, providing useful tools and

fundamental knowledge of the spoilage and hazard. It will also impact on the research and informatics communities.

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**NBR: 211778** **ACRONYM: NANOMODEL** **EC FUND: 3481149**

**DG:** RTD **Call: FP7-NMP-2007-SMALL-1** **Thema:** NMP-2007-2.5-2

**Title:** Multi-Scale Modeling of Nano-Structured Polymeric Materials: From Chemistry to Materials Performance

**Abstract:** The practice of adding micron sized inorganic filler particles to reinforce polymeric materials can be traced back to the early years of the composite industry. With synthetic methods that can produce nanometer sized fillers, resulting in an enormous increase of surface area, polymers reinforced with nanoscale particles should show vastly improved properties. Yet, experimental evidence suggests that a simple extrapolation of the design paradigms of conventional composites cannot be used to predict the be-havior of nanocomposites. The origin of these differences between conventional and nanocomposites is still unknown. This, unfortunately, precludes yet any rational design.Though some property improvements have been achieved in nanocomposites, nanoparticle dispersion is difficult to control, with both thermodynamic and kinetic processes playing significant roles. It has been demonstrated that dispersed spherical nanoparticles can yield a range of multi-functional behavior, including a viscosity decrease, reduction of thermal deg-radation, increased mechanical damping, enriched electrical and/or magnetic performance and control of thermomechanical properties. Especially the decrease in viscosity is advantageous for injection-molding op-erations. Facile tuning of nanocomposite Tg could thus allow us to control the usable temperature range of these materials. Again, the physics under-pinning this behavior remains unresolved, primarily due to the poor understanding of the effects that particle/matrix interactions have on the composite behavior. This project aims at overcoming these deficiencies by a twofold strategy. This project will bring together a critical mass of scientists, from atomistic to finite-element modeling. The goal is to develop, implement and validate multi-scale methods to compute the mechanical, thermochemical and flow behav-iour of nano-filled polymeric materials – based on the chemistry of selected model systems.

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**NBR: 211806** **ACRONYM: EUROTRAINING** **EC FUND: 1398009**

**DG:** CNECT **Call: FP7-ICT-2007-1** **Thema:** ICT-2007.3.1

**Title:** Provision of a European training infrastructure

**Abstract:** The objective of the EuroTraining proposal is to provide a European Training Infrastructure facilitating the provision of high calibre training across Europe. The structure will support professional advancement training as well as academic training. Professional course providers will get a central place for the presentation of their training offer while academics will get a course material exchange service targeting graduate nanoelectronics schools. The action will offer access to a comprehensive range of advanced training courses, course material and thematic SME employee training support. Special attention will be devoted to stimulate the development of new courses supporting the CMOS technology targeting digital components and complex digital SoCs ("More Moore"); to master diversification targeting non-digital applications, heterogeneous integration in SoCs or SiPs ("More than Moore") and to prepare for the technology generation beyond the CMOS scaling limits ("beyond CMOS"). The training offer will be based on proper market surveys and dedicated training roadmaps derived from e.g. ENIAC/ITRS. The initiative consists of: 1. A continuing training programme to offer high calibre quality labelled training in all Europe. Two very important EuroTraining assets are the European Course Directory containing more than 400 updated continuing training courses and the accredited Quality Labelling service. 2. An action to support graduate schools in micro- and nanoelectronics with courses, workshops and training material. 3. All services offered will be gathered in the European Training Infrastructure web site, promoting the training services and attracting participants. The website will contain updated information on as well graduate university courses, course material and continued training offers as well as bursary schemes, Train-the-Trainers programmes, Qualified Bank of Internet Links and training market intelligence.

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**NBR: 211906** **ACRONYM: NANODETECT** **EC FUND: 2108788**

**DG:** RTD **Call: FP7-KBBE-2007-1** **Thema:** KBBE-2007-2-3-04

**Title:** Development of nanosensors for the detection of quality parameters along the food chain

**Abstract:** In NANODETECT, the nanoreaction technology will be used to develop on-line and off-line monitoring systems (sensors) which combine the expertise of sensitive molecular biological processes with the potency of nanotechnology for application in liquid process food streams. The nanosensors will interact with information technology tools and thus contribute to improved quality control systems within small and large industries. The partners have chosen milk as example process stream because it is subject to different contaminations of which the following were chosen as models: Pathogenic microorganisms (e.g. Listeria monocytogenes), Mycotoxins (e.g. Aflatoxin M1), Drug residues (e.g. sulphonamides) and Fraud (e.g. high value goat milk blended with cow milk). The nanosensors will work on different types of immunoassays, depending on the application. Single modules will be developed for the detection and quantification of specific contaminants which can be combined according to user's requirements. It is

planned to develop on-line systems with suitable software and automated decision support systems (DSS) for large industries as well as bench top and or handheld devices for small companies with flexible production units. Up to now, there is no technology available for the rapid, in-situ recognition and quantification of unwanted substances in liquid process streams. The device includes a dedicated nanosystem for sample preparation that allows the passage of each molecule of the process stream and associated immuno-assays for the direct quantification of the contaminants in the process stream. The novel sensor will comprise activated nanostructures and innovative techniques for a specific concentration within sample preparation and analysis, respectively. This innovative technology features advantages such as significantly lower costs, high conversion rates, direct quantification, and to be realized as in-line as well as bench top and or handheld device.

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**NBR: 211948** **ACRONYM: CLEAR-UP** **EC FUND: 8300000**

**DG:** RTD **Call: FP7-NMP-2007-LARGE-1** **Thema:** NMP-2007-4.0-5

**Title:** Clean buildings along with resource efficiency enhancement using appropriate materials and technology

**Abstract:** Clear-up presents a holistic approach to the reducing operational energy use in buildings. By development and novel use of nano-materials it aims to increase energy performance in heating, ventilation, air conditioning (HVAC) and lighting systems, and to improve indoor air quality using catalytic purification. Clear-up's solutions are designed for retro-fitting existing buildings and of course for new constructions. It will achieve this by addressing four key components which control the indoor environment: • Windows. Clear-up will advance the practical use of shutters and electrochromic window foils which reduce the building cooling load and along with light-guide technology, reduce the need for artificial lighting. • Walls. Clear-up will use photocatalytic materials for air purification and nano-porous vacuum insulation in combination with phase change materials to passively control temperature. • Air Conditioning. Clear-up will advance technologies for demand controlled ventilation and improved air quality. • Sensors and control provide an underpinning technology for Clear-up's approach. New sensors will be developed, and their use optimised for the operation of smart windows; demand controlled ventilation; and catalytic purification. Clear-up will develop, install, measure and evaluate technological solutions in the laboratory, in a large-scale testing facility and in real world applications. Its approach will be demonstrated at the UN Climate Summit in Copenhagen, 2009. The safety of new materials will be considered; it will propose inputs to standards and environmental product declarations for its technologies. Clear-up will also investigate environmental and economic lifecycles for components and systems. The practical issues of exploitation will be addressed in cooperation with industry bodies ECTP, ECCREDI and ENBRI providing access to large firms and SMEs.

**NBR: 211956** **ACRONYM: ETSF** **EC FUND: 3800000**

**DG:** CNECT **Call: FP7-INFRASTRUCTURES-2007-1** **Thema:** INFRA-2007-1.2-02

**Title:** European Theoretical Spectroscopy Facility I3

**Abstract:** The European Theoretical Spectroscopy Facility addresses an important need of European science and technology by providing experimental, industrial and other researchers with access to state-of-the-art computer simulation tools for electronic excited states in matter, together with high-quality support from ETSF personnel, mirroring the massive progress in the power and resolution of new European experimental facilities. All domains that need knowledge about electronic excitations, transport and spectroscopy will benefit from the ETSF, such as condensed matter physics and chemistry, biology, materials science and nanoscience, atmospheric science, and astrophysics. The ETSF provides users with computer codes, background knowledge, customised support and development, training, and collaborators to enhance their studies of the electronic and transport properties of complex or nanoscale materials. Its focus is on the rapid transfer of ground-breaking fundamental knowledge of matter, at the quantum-mechanical level, to detailed understanding and future-oriented design of prototypical or technologically relevant systems. The ETSF has been successfully designed and recently brought into operation by the Nanoquanta Network of Excellence with the support of national and local institutions. In the present ETSF-I3 project, the ETSF is partnered by the Barcelona Supercomputing Centre to create a framework for deploying the ETSF infrastructure to a much wider range of users, through user training and projects supported by ETSF scientists. The ETSF-I3 project will monitor the scientific and technological needs of users, and will boost the user-oriented development of ETSF software, algorithms and libraries made available on the most advanced computational platforms. ETSF-I3 will be crucial to keep the ETSF at the forefront of knowledge and establish it as the world-wide reference centre for modelling of electronic excited states.

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**NBR: 212043** **ACRONYM: NAD** **EC FUND: 10921350**

**DG:** RTD **Call: FP7-NMP-2007-LARGE-1** **Thema:** NMP-2007-4.0-4

**Title:** NANOPARTICLES FOR THERAPY AND DIAGNOSIS OF ALZHEIMER DISEASE

**Abstract:** The search for effective therapies and early detection strategies for Alzheimer's Disease (AD), the major cause of dementia in Europe, is imperative. It is known that β-amyloid (Aβ) peptide plays a central role in neurodegeneration. In AD brain, Aβ is released in a soluble form that progressively becomes insoluble forming aggregates; extracellular

plaques mainly composed of Aβ are a hallmark of post-mortem brains. These premises strongly suggest brain Aβ as a possible target for therapy and diagnosis of AD. In addition, it is known that brain and blood Aβ pools are in equilibrium via the blood-brain-barrier (BBB). Accordingly, it has been reported that removal of blood Aβ may withdraw the excess of brain Aβ by a "sink" effect. Thus, blood Aβ is another potential target. The aim of this project is to utilize nanoparticles (NPs) specifically engineered for targeting brain Aβ, for the combined diagnosis and therapy (theranostics) of AD. NPs (liposomes, solid lipid NPs, polymeric-NPs) will be multiple-functionalized with: i) a large arsenal of molecules (specific lipids, antiamyloidogenic drugs, polyphenols, heteroaromatic compounds, unnatural peptides and peptidomimetics, antibodies) interacting with Aβ in all aggregation forms, ii) PET or MRI contrast agents detecting such interaction, iii) molecules stimulating BBB crossing via the transcytotic route. Several artificial and cellular models will be used to fine-tune such features and to improve NPs biocompatibility, non-immunogenicity, non-toxicity and physical stability. Eventually, absorption, distribution, metabolism and excretion will be studied using animal models of AD. Different routes (i.v., oral, nasal) and protocols (two-step, NPs cocktails, aerosols) of administration will be utilized to boost NPs brain delivery. The prediction is that NPs will detect, disaggregate and remove Aβ brain deposits. In any case, NPs will interact with blood Aβ, withdrawing the excess of brain peptide by a "sink" effect.

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**NBR: 212105** **ACRONYM: ELI-PP** **EC FUND: 6000000**

**DG:** RTD **Call: FP7-INFRASTRUCTURES-2007-1** **Thema:** INFRA-2007-2.2-01

**Title:** Extreme Light Infrastructure Preparatory Phase

**Abstract:** Among the most significant scientific inquiries defined by Science (July 2005) was whether or not scientists will be able to build a laser of intensity sufficient to "rip photons into electron-positron pairs." ELI will be the first infrastructure to approach this limit. It represents the consensual effort of 13 European countries, more than 50 laboratories and numerous international collaborators. Dedicated to the fundamental study of laser-matter interaction in a new and unsurpassed, "ultra-relativistic" regime, this facility will be based on an exawatt-class laser delivering ultra-short (down to fractions of attosecond) pulses at least 100 times more powerful than any other existing or planned. ELI will strive to be a highly multidisciplinary platform with specialized laser, particle or radiation beam lines dedicated to wide scientific fields, from fundamental ones: atomic, particle, nuclear, gravitational, and cosmology, to societal ones. ELI will for instance benefit in life science, nanotechnology material science, or environment. ELI will finally foster technology transfers, as well as education and training. The ELI preparatory phase aims at establishing all the elements for the start of a successful construction and operation of the facility. It includes the technical studies that define within strict safety guidelines, the laser and its experimental ancillaries characteristics,

leading into site selection issues. It examines the legal and governance networking elements that will ensure a stable and smooth operation. It allows steady evaluation of construction and operation costs, as well as decommissioning ones. This three years period will furthermore allow investigating new opportunities opened by the ultra-relativistic regime and consolidating the European users community and its international counterparts.

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**NBR: 212206** **ACRONYM: COST-EFFECTIVE** **EC FUND: 7492346**

**DG:** RTD **Call: FP7-NMP-2007-LARGE-1** **Thema:** NMP-2007-4.0-5

**Title:** Resource- and Cost-effective integration of renewables in existing high-rise buildings

**Abstract:** The use of renewable energy in the building sector is today dominated by the application of solar domestic hot water and PV systems in single-family houses. In order to significantly increase the use of renewable energy in the building sector, concepts have to be developed for large buildings. In these buildings high fractions of the energy demand can only be met with renewable energy sources, when the façade is used for energy conversion in addition to the roof. This is especially true for buildings with a small roof area compared to the floor area ("high-rise buildings") and for existing buildings which generally have a higher energy demand than new buildings. Therefore the main focus of the project is to convert facades of existing "high-rise buildings" into multifunctional, energy gaining components. This goal will be achieved through the - development of new multi-functional façade components which combine standard features and the use of renewable energy resources and the - development of new business and cost models which consider the whole life cycle of a building and which incorporate the benefits from reduced running costs and greenhouse-gas emissions. The new components will in particular profit from the application of nano-structured coatings and films which will enhance their performance and durability due to antireflective, anti-soiling and seasonal shading functionality. In order to achieve a successful development and implementation of these new technologies and concepts European key actors from construction industry and energy research have agreed to collaborate within this project. The project results will be an important support for the European technology platforms ECTP, ESTTP and PV-platform in which the project partners have a leading role.

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**NBR: 212257** **ACRONYM: MASTER** **EC FUND: 2044210**

**DG:** RTD **Call: FP7-NMP-2007-SMALL-1** **Thema:** NMP-2007-2.2-2

**Title:** Microwave Amplification by Spin Transfer Emission Radiation

**Abstract:** The intended aim of this project is to explore the application potential of novel Spin-Transfer Oscillators (STO) as tunable and ultra-narrow band microwave radiation sources for mobile and wireless telecommunication technology. The main technological interest of STO devices, which correspond to nano-structured magnetic multilayer pumped by a spin-polarized electrical current and emitting microwave radiation, is their compatibility with monolithic integration. Our proposal specifically addresses the bottleneck issue of power conversion efficiency between dc current pumping and microwave emission of radiation. We propose to take advantage of the phase-locking mechanisms between coupled oscillators to increase significantly the device performance. Our primary objective is to engineer large arrays of coherently coupled oscillators. To achieve this goal, we shall investigate in detail 4 different types of coupling mechanism between neighboring oscillators which may induce phase-locking of the ensemble: 1) coupling through the self-generated microwave current, 2) coupling through the dipolar magnetic field, 3) coupling through the spin-diffusion of the conduction electrons, 4) coupling mediated by spin-waves. Achieving phase-locking between neighboring oscillators also requires substantial progress in our understanding of the fundamental mechanisms that are involved during momentum-transfer from spin-polarized current to the magnetic moments. Our secondary objective is to address both experimentally and theoretically 3 knowledge gaps: identifying (spatio-temporal profile and relaxation times) the fundamental spin-wave eigen-modes excited by a dc current in nano-structured magnetic heterojunctions; understanding the fundamental mechanism underlying non-local effects associated with the diffusion of spin-polarized electrons and its action on the dynamics of the whole system; investigating the magnetization dynamics of a nano-structure in the non-linear regime.

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**NBR: 212311** **ACRONYM: ONE-P** **EC FUND: 17989814**

**DG:** RTD **Call: FP7-NMP-2007-LARGE-1** **Thema:** NMP-2007-2.2-1

**Title:** Organic Nanomaterials for Electronics and Photonics: Design, Synthesis, Characterization, Processing, Fabrication and Applications

**Abstract:** The call 4.2.2-1 “organic materials for electronics and photonics” is based on the observation that the limited availability of high-performance multi-functional materials is a roadblock to further industrial progress. To address the wide scope of the call, we have identified specific materials bottlenecks to the fields of electronics and photonics. They constitute the focal points of our project. One-P main objective is: “to invent, design, synthesize, characterize, process, and to supply the missing materials in the fields of organic electronics and photonics and to develop appropriate patterning methods for micro- and nano-structuring of these materials that can be up-scaled to roll-to-roll technologies”. The work plan is composed of five technical workpackages,

each one addressing current materials challenges: 1) charge transport and injection, 2) detection and sensing, 3) light emission, 4) functional self-assembled monolayers, 5) continuous processing and technology. Computer-aided design of materials and the use of advanced characterization tools are transversal activities that are integrated in technical workpackages. The sixth workpackage is devoted to dissemination, exploitation, and management of intellectual properties that are essential for the project success. To carry out this multi-disciplinary project, a cross-sectorial consortium has been formed at the European level. It is composed of strong academic and industrial teams with necessary and complementary expertises to cover all scientific, technological and exploitation aspects. The project will generate fundamental knowledge and help to develop unprecedented technologies. They will have a positive impact on competitiveness of European industries, environment, job creation, health, security, safety, and welfare of European citizens

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**NBR: 212348** **ACRONYM: NFFA** **EC FUND: 1800000**

**DG:** RTD **Call: FP7-INFRASTRUCTURES-2007-1** **Thema:** INFRA-2007-2.1-01

**Title:** Nanoscience Foundries and Fine Analysis

**Abstract:** We intend to study the feasibility of an European cluster of nanoscience facilities, which will consist of 3-6 Centres closely attached to a number of selected Large Scale Facilities located within Europe (synchrotron radiation sources, neutron scattering sources, high power lasers including free electron lasers and high performance computing, etc). This cluster of nanoscience facilities will enable users to conduct fine analysis experiments and modelling at the nanoscale by offering access to state-of-the-art synthesis, nanofabrication and analysis to a wide research community. Hence, by providing innovative cutting edge preparation and characterization technologies to European scientists, this delocalized institution will raise the standards of nanoscience experiments in the European Research Area and allow full exploitation of the affiliated Large Scale Facilities. The NFFA design study will develop the Emerging Proposals, named NANOSCIENCE, in synergy with the ESFRI roadmap 2006. NFFA is a structuring project for the ERA that requires to be started with support by the EC under FP7, in order to reach the maturity to be validated as a potential RI by ESFRI. The NFFA Centres for users will share a common technical platform for advanced nanofabrication and characterization of nanostructures, complemented by specialised methods for synthesis of materials, specific analysis, computational methods of simulation, according to a coordinated science plan. The NFFA design study will analyse the full spectrum of Research infrastructures relevant for nanoscience that are currently in operation OR in the preparatory phase of FP7.

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**NBR: 212533** **ACRONYM: BIOELECTRICSURFACE** **EC FUND: 3540643**

**DG:** RTD **Call: FP7-NMP-2007-SMALL-1** **Thema:** NMP-2007-1.1-1

**Title:** Electrically modified biomaterials surface

**Abstract:** According to the World Health Organisation (WHO), cardiovascular diseases cause half the deaths in the EU. It is also the main cause of years of life lost (over 30 per cent) in early death thus causing huge pressure on the labour force and family earnings. The problem is becoming more acute in Central and Eastern European countries. Due to the ageing population in the EU, osteoporosis related bone fractures have almost doubled in the last decade. It is estimated that 40 percent of women over 50 years in age will suffer from fractures due to low density bone. The European Commission considers the application of nanotechnology an important research strategy to address these problems. For this, design and control of biomaterial at the nanometer scale is set as a strategic research priority. Europe is, however, seriously under-represented in the global market for nanotherapeutics, where the United States dominates with three-quarter of the market share. While the drive for nanoscale understanding of biological interaction can be high, the application of this knowledge in marketable devices should also be prioritised. Here, we propose electrical modification of biomaterials surface to manipulate surface charge that will mediate bio/non bio interactions in vivo. We propose novel nanoscale techniques to probe this surface charge at the nanometer scale so that we have a quantitative insight to biological interaction at the biomedical device surfaces. Such an approach will help us to scale up electrical modification in cardiovascular stents, urological stents, orthopedic implants and photosterilisation devices. The research proposed here will not only provide nanoscale understanding of biological interactions on biomaterials surface but also result in novel applications and devices, which will penetrate into the market in short to medium term.

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**NBR: 212919** **ACRONYM: PRINS** **EC FUND: 1000000**

**DG:** RTD **Call: FP7-INFRASTRUCTURES-2007-1** **Thema:** INFRA-2007-2.2-01

**Title:** Pan-European Reseach Infrastructure for Nano-Structures

**Abstract:** The project focuses on all needed preparatory actions to enable in the following phase the construction of a Research Infrastructure (RI) called Pan-European Research Infrastructure for Nano-Structures (PRINS), with the aim of enabling European innovative research for the ultimate scaling of electronics component and circuits. The platform will be truly interdisciplinary by allowing the convergence of “top-down” technology, which is today the main enabler of Moore’s law (i.e. transistor scaling), with “bottom-up” methods derived from fundamental disciplines such as material physics,

chemistry, biotechnology and particle electronics. The open access of this infrastructure provided to the Scientific Community will enable the cross-disciplinary fertilization of academic and industrial competences in the areas of nanoelectronics, nanosystems, nanobiology, nanophotonics, etc. The consortium consists of European leading Research Centres, industrial partners and Public Authorities and Funding Agencies. Key activities include 1) setting up a legal framework for the operation of the RI, 2) defining the required management structures for the daily operation of the RI, for screening and evaluating the incoming access requests, and for technical and financial aspects related to the strategy of the RI and its long term sustainability, including the role of the different stakeholders and possible funding schemes, 3) defining the legal and practical issues related to the different operation modes for giving access ad hosting researchers, and 4) defining the timeline of the RI, its different areas, and its associated business plan (operational costs, resources, funding possibilities, costs for giving access, etc).

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**NBR: 212942** **ACRONYM: FUNMOLS** **EC FUND: 2799062**

**DG:** REA **Call: FP7-PEOPLE-2007-1-1-ITN** **Thema:** PEOPLE-2007-1-1-ITN

**Title:** Fundamentals of Molecular Electronic Assemblies

**Abstract:** The FUNMOLS network will tackle major challenges in the field of molecular electronics. Ten internationally-leading European research groups from five different countries [including one of Europe's leading industrial electronics-research groups (IBM Zurich)] have joined forces as full participants, combining expertise in synthetic chemistry, nanoscale physics and device engineering, surface electrochemistry and electronic structure calculations. Our highly-integrated approach involves a convergence of experiments – including syntheses – and theory in electron transport through single molecules, which will represent a major step towards the realisation of future scalable molecular electronics technologies and processes. In the longer term, the insights gained will contribute to the fabrication of functional nanoscopic architectures and their integration into a higher hierarchical level. System parameters like electric field, light, temperature or chemical reactivity are envisaged as possible triggers of future nanoelectronic devices. This European consortium is committed to promote breakthroughs at the frontier of science. The training dimension of the FUNMOLS network is reflected in the high priority we will give to a series of actions specifically aimed at early stage researchers (ESRs). These include: education and knowledge dissemination through the organisation of Workshops, Tutorial Courses, Annual Network Meetings, Training Schools, International Conferences and Mobility Programmes. The network as a whole builds on several fruitful collaborations between the PIs and seeks to close an existing educational gap in the European Research Arena. The development of complementary skills (presentation, management, technology transfer, IP protection) will be implemented actively throughout the lifetime of the project. A constant

interaction beyond those involved primarily in research will provide the wider scientific community with information on our new technology.

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**NBR: 213126** **ACRONYM: LABSYNC** **EC FUND: 1599457**

**DG:** RTD **Call: FP7-INFRASTRUCTURES-2007-1** **Thema:** INFRA-2007-2.1-01

**Title:** Laboratory compact light sources

**Abstract:** The need for advanced light sources is well documented by the creation of new facilities such as SOLEIL, DIAMOND, MAX IV and the upgrades of older facilities. The applications of light sources encompass all aspects of sciences spanning the fields of physics, chemistry, biology, material science, electronics and medicine. An option to provide "more light" to this community is to develop small laboratory sources beyond the standard and rotating anodes. Recently, several "small scale synchrotron" sources were proposed, whereby the most advanced system is the Mirrorcle© developed by Prof. Yamada (Japan) with three functioning systems. In this project, we will design a complete small facility around the Mirrorcle© source. The Mirrorcle© is based on two RF klystron driven microtrons to accelerate the electrons first and second to obtain a electron storage ring with constant energy (6 MeV or 20 MeV) and high current (3A). The relativistic electrons produce intense far infrared radiation (FIR) and when targets are inserted in the electron path intense soft and hard X-rays can be produced from 90 eV up to the electron energy. The first goal of this project is to complete the characterization of the full radiation spectrum generated by the Mirrorcle© . This includes parameters such as the brilliance, the beam divergence, polarization and monochromacity. The second goal is to design a specific Mirrorcle© ring with four output ports, namely a FIR port, a soft X-rays port, a hard X-rays port and one port where the full spectrum is available. This includes designing the required targets as well as internal mirrors configurations. The third goal is to design specific beam-lines for these four ports that take into account the source. Finally, two specific user stations will be designed that make use of the unique abilities offered by such a small scale source, namely a multi-diagnostic in-situ, real-time nano-material synthesis system and a medical imaging and therapy station. In the first two years if the project the focus was indeed on using the Mirrorcle as the source for photons. In the third year of the project that has changes and the activities related to the Mirrorcle have stopped. They have been replaced by activities with liquid metal jet sources (for hard x-rays) and with laser plasma sources (for soft x-rays). However the general design goals have remained the same throughout the project.

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**NBR: 213202** **ACRONYM: SKIN TREAT** **EC FUND: 3950035**

**DG:** RTD **Call: FP7-NMP-2007-SME-1** **Thema:** NMP-2007-3.1-2

**Title:** Novel approaches for the development of customized skin treatments and services (Test case: Dead Sea Minerals and Conventional drugs)

**Abstract:** Economical and health interests of skin problems are fast growing issues in Europe, following the remarkable extension in life expectancy in western countries, together with the increased awareness of UV radiation risks. Personalized health care approach has been discussed over the past few years and had been accompanied by developing innovative technologies capable of identifying specific biomarkers, supporting a personalized diagnosis and treatments, especially concerning bio-compatibility of drugs. Skin Treat intends to develop and validate nano-chemical and bio- technologies to achieve an accurate matching of drugs, and drug delivery vehicles, to skin diseases and sub pathogenic skin conditions in their individual context. The project will design novel generation of pharmaceutical products, as well as consumer personalized service, in order to fit customers' tailored needs with a support of strategic consortium based on partnership among SMEs and research organizations. The development of personalized skin therapy protocols requires achieving an accurate diagnostics of skin condition and an extensive analysis of biological markers. Non invasive methods as well as minimal invasive skin sampling, will support the establishment of a range of biological profiles corresponding to skin diseases and skin sub pathologic conditions. Statistical processing of these data will allow defining biomarkers patterns specifically associated with given clinical conditions. A bio-informatics data mining protocol will be elaborated, together with multifunctional biomarker analysis software, to build a refined, personalized diagnosis method. Finally, the computer data analysis will yield a decision support system (DSS) to assist dermatologists, chemist and clients for prescription of personalized treatment. Skin Treat concept will be evaluated by a wet pilot study of the whole ervice chain on a few, selected skin disorders like psoriasis, contact dermatitis, and UV skin photo-aging damages.

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**NBR: 213219** **ACRONYM: BION** **EC FUND: 1303000**

**DG:** CNECT **Call: FP7-ICT-2007-C** **Thema:** ICT-2007.8.0

**Title:** Synthetic Pathways to bio-inspired information processing

**Abstract:** We shall use data from neuroanatomy and neurophysiology as a guide for the fabrication of deterministic and complex self-assembled networks of polymeric non linear elements with adaptive properties. The main objective is the realization of a new technology for the production of functional molecular assemblies, which can perform advanced tasks involving learning and decision making, and which can be tailored down to the nanoscale. The polymer network shall be prepared using molecular deposition and self assembly techniques in two and three dimensions. Electron beams shall be used

for microelectrode configurations and for sample modification. Non linear elements will be provided by Schottky junctions, functionalized gold nanoparticles or molecular heterojunctions, which will be statistically dispersed in the matrix, to mimic the synaptic and neuronal distribution in biological systems as obtained from neuroanatomical data. We shall start with polyaniline embedded in ionic polyethyleneoxide, but other polymeric systems will be explored. The polymers will be functionalized to influence the deposition or self-assembly processes. To train the network we shall use mainly electrochemical modification of the polymer conductivity, for which we have already demonstrated the basic functional behaviour. . We shall monitor the network transfer function, for different types of signal input, including signal dependent noise. Artificial Intelligence algorithms and specifically developed statistical correlation techniques shall be used throughout. Upon success, the data shall be compared and connected to electrophysiological data obtained for brain systems of different complexity: first the simpler and more deterministic case of the pond snail and subsequently in the far more complex statistically distributed cases of cognitive processes in the cerebral cortex of the mammalian brain.

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**NBR: 213238** **ACRONYM: RAINBOW** **EC FUND: 4778667**

**DG:** REA **Call: FP7-PEOPLE-2007-1-1-ITN** **Thema:** PEOPLE-2007-1-1-ITN

**Title:** High quality Material and intrinsic Properties of InN and indium rich Nitride Alloys - (The RAINBOW ITN)

**Abstract:** Indium nitride is a new narrow gap semiconductor (

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**NBR: 213267** **ACRONYM: LAYSA** **EC FUND: 3007603**

**DG:** RTD **Call: FP7-AAT-2007-RTD-1** **Thema:** AAT-2007-3.3-02

**Title:** MULTIFUNCTIONAL LAYERS FOR SAFER AIRCRAFT COMPOSITES STRUCTURES

**Abstract:** The use of composite materials in aeronautics industry has increased constantly over the last 35 years, due mainly to their high specific strength and stiffness combined with the possibility of designing complex geometry components that are more aerodynamically efficient than metals. But due to organic nature of polymeric matrix component, composite materials are electrically and thermally bad conductors and they tend to burn easily, emitting toxic gases and smoke. For that, they require affordable, effective and certifiable protection systems against atmospheric hazards such as icing, as well as fire and burning in case of accidents. Moreover, improved in field inspection techniques are required with the increased use of composite materials. Current technologies address

those issues separately; ice protection is usually performed by mean of a metal mesh or foil incorporated into the outer ply of fabric on the skin of the structure, fire protection is performed with thermal barrier coatings on the structures and life monitoring is performed with embedded sensors. All of them add high weight penalty and complexity during the component manufacturing and posterior maintenance, even may go against the structural integrity of the component in some cases. LAYSA project aims for a new multifunctional layer to be integrated into composite structures, with ice and fire protection capacity. This can be achieved by integrating nanomaterials (NMs) such as Carbon Nanotubes (CNTs) or Carbon Nanofibres (CNFs) within a polymeric matrix, so that the whole nanocompoiste can be integrated in the composite structure like a layer. The direct benefits of the proposed application include: a) Improve aircraft safety and security, b) Structural weight reduction and simplification of manufacturing processes and maintenance operations due to elimination of current metals mesh or foils, by replacement with multifunctional layer integrated in composite structure.

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**NBR: 213277** **ACRONYM: HARCANA** **EC FUND: 5442052**

**DG:** RTD **Call: FP7-NMP-2007-LARGE-1** **Thema:** NMP-2007-2.1-1

**Title:** High Aspect Ratio Carbon-based Nanocomposites

**Abstract:** High aspect ratio carbon-based nanoparticles (nanotubes (CNT), nanofibres (CNF), and nanosheets or exfoliated graphite (CNS)) will be introduced into bulk polymers, into polymeric foams and into membranes. It is expected that such nanofillers will tremendously improve and modify the properties of these families of materials, allowing them to reach new markets. However, a common and fundamental problem in polymer-based nanocomposites is the large extent of agglomeration of the nanoparticles due to their high surface to volume ratio. Therefore, techniques to control deagglomeration and possibly further organization of these high aspect ratio nanoparticles in polymeric materials remain a challenge. This project under industrial leadership will therefore aim at mastering, at the nanometric and mesoscale level, the spatial organization of carbon-based nanoparticles (CNP) with various surface functionalities, sizes and shapes having large aspect ratios in bulk, foamed and thin film (membranes) polymers by using industrially viable processes. More precisely, the aim of this proposal consists in generating polymer-based nanocomposites with a percolating nanoparticle structure that is reinforcing the material and imparts it with improved electrical and thermal conductivity at a minimum of nanoparticle loading. To reach such radically improved properties, it is important to take into account that a complete dispersion is not useful and will lead to lower properties. In order to control this CNP organization within the polymer matrix, a large set of techniques will be used. They range from synthetic approaches ("grafting from", "grafting to", "grafting through", emulsion polymerization) to (reactive) melt or solution blending processes, and to preparation in supercritical CO2. The aim is to generate new classes of engineering materials for various applications

like EMI shielding, antistatic packaging materials and membranes, as well as scaffolds for tissue engineering.

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**NBR: 213382** **ACRONYM: FUNMOL** **EC FUND: 3464710**

**DG:** RTD **Call: FP7-NMP-2007-SMALL-1** **Thema:** NMP-2007-1.1-2

**Title:** Multi-scale Formation of Functional Nanocrystal-Molecule Assemblies and Architectures

**Abstract:** Recent developments in the design and synthesis of nanoscale building blocks as active elements in opto- or bio-electronic devices with tailored electronic functionality have the potential to open up new horizons in nanoscience and also revolutionise multi-billion dollar markets across multiple technology sectors including healthcare, printable electronics, and security. Ligand-stabilised inorganic nanocrystals (~2-30 nm core diameters) and functional organic molecules are attractive building blocks due to their size dependent opto-electronic properties, the availability of low-cost synthesis processes and the potential for formation of ordered structures via (bio) molecular recognition and self-assembly. Harnessing the complementary properties of both nanocrystals and functional molecules thus represents a unique opportunity for generation of new knowledge and development of new classes of high knowledge-content materials with specific functionality tailored for key applications, e.g., printable electronics, biosensing or energy conversion in the medium term, and radically new information and signal processing paradigms in the long term. Self-assembly and self-organisation processes offer the potential to achieve dimensional control of novel multifunctional materials at length scales not accessible to conventional “top-down” technologies based on lithography. It is critical for European industry to develop new knowledge and low-cost, scaleable processes for assembly and electrical interfacing of these multifunctional materials with conventional contact electrodes in order to produce into tailored devices and products, in particular on low-cost substrates. The FUNMOL consortium will deliver substantial innovation to European industry via development of cost-effective, scaleable processes for directed assembly of high-knowledge content nanocrystal-molecule materials into electrically-interfaced devices at silicon oxide, glass and plastic substrates.

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**NBR: 213390** **ACRONYM: PHOME** **EC FUND: 1431480**

**DG:** CNECT **Call: FP7-ICT-2007-C** **Thema:** ICT-2007.8.0

**Title:** Photonic Metamaterials

**Abstract:** Metamaterials are composite, man-made materials, composed of sub-wavelength metallic building blocks, which show novel and unique electromagnetic properties, not occurring in natural materials. A particularly important class of such materials is the negative refractive index metamaterials (NIM). NIM have been in the foreground of scientific interest in the last seven years. In 2006-2007 near infrared and optical frequencies were obtained, despite the initial objections and disbelief. However, many serious obstacles have to be overcome before the impressive possibilities of optical/photonic metamaterials (PMM) can become real applications. The present project identifies the main obstacles and proposes specific approaches to deal with them; in addition, it intends to study novel and unexplored capabilities of PMM. Specifically, the project objectives are (a) realization of 3D PMM, (b) reduction of losses in PMM, (c) realization of active and tunable/switchable (electrically or optically) PMM by incorporating gain or nonlinearity, and (d) realization of chiral PMM. The accomplishment of those objectives is both a theoretical and a technological challenge, as it requires proofs of concepts, advanced computational techniques and advanced nanofabrication approaches. To guide and test the proposed PMM development effort we have identified a number of important and ICT relevant demonstrators, which include thin-film optical isolators, electro-optic modulators, optical switching, and NIM-based "perfect lenses" in the infrared, and possibly in the visible. The implementation of the project will be done through combined theory/modeling, fabrication and experimental testing efforts, in continuous interaction. The broad theoretical and experimental expertise of the proposers, together with their field shaping past contributions to metamaterials, make them capable to face the challenges involved and to minimize the risk, ensuring the maximum possible success of the project.

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**NBR: 213436** **ACRONYM: NANOTOUGH** **EC FUND: 5089000**

**DG:** RTD **Call: FP7-NMP-2007-LARGE-1** **Thema:** NMP-2007-2.1-1

**Title:** Nanostructured Toughened Hybrid Nanocomposites for High Performance Applications.

**Abstract:** Motivation: Nanocomposites are emerging new materials that promise improved properties. Their applicability, however, is presently limited by the cost of manufacture and product reproducibility. Literature shows that on the bench scale, dramatic improvement in polyolefin mechanical properties can be obtained by intercalation and exfoliation of nanoparticles in the matrix. However, when materials produced using conventional equipment are tested, their performance does not meet expectations nor live up to the claims (eg. the impact strength too low). Project Goals: To remove technical barriers to producing high performance polymer nanocomposites on the industrial scale, fundamental insight into the dispersion of particles within the matrix is needed. The goal of this project is to gain this insight through a series of carefully designed studies, using the most advanced experimental techniques, theoretical modeling, carried out by very experienced and skilled partners working together in a

targeted and interdisciplinary fashion. The basic objective is to obtain a deeper understanding of the interfacial structure of nanocomposites within a polyolefin matrix. This knowledge will enable realization of the great performance potential of these materials through development of novel multiphase and hybrid nanocomposites. This knowledge will facilitate commercialization of polymer nanocomposite materials with superior properties that will lead to development of new products. To meet this objective, we aim to improve the stiffness of polyolefin nanocomposites while not only maintaining but also improving the toughness of the matrix considerably. The technological objective is to optimize and, through novel interface design, to develop new cost efficient hybrid (nanofiller–fiber) nanocomposites as an alternative to heavily filled polymers and expensive engineering polymers and fulfil industry requirements for high performance materials in high tech applications.

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**NBR: 213487** **ACRONYM: ERUDESP** **EC FUND: 2749909**

**DG:** RTD **Call: FP7-NMP-2007-SMALL-1** **Thema:** NMP-2007-2.4-2

**Title:** Development of Electrochemical Reactors Using Dehydrogenases for Enantiopure Synthon Preparations

**Abstract:** The aim of the project is the development of electrochemical reactors for the manufacture of fine chemicals with dehydrogenases as a process with almost zero waste emission. The production of enantio pure compounds with high EE's can be achieved by using dehydrogenases as biocatalysts, because they express high enantio selectivity in ketone reduction, combined with broad substrate spectra by some of these enzymes. These proteins will be engineered for improved catalytic performance using the tools of molecular evolution, modelling, structure prediction, and crystallography. As these dehydrogenases typically require cosubstrate regeneration by aid of a second enzymatic reaction, we are looking for the alternative solution of an electrochemical approach for the regeneration of reduced cofactors. If all active compounds can be functionally immobilized on the electrode surface the constructed reactor would convert the educt in the input flow to the product in the output flow avoiding any contaminations. All necessary components like the mediator, the cofactor and the dehydrogenase will be bound to nano or meso structured electrodes (for increased active surface area) resulting in biofunctionalised surfaces with tailored properties at the nanoscale. Optimization of the electrode materials and surfaces, of the mediators and the required spacers as well as the surface bound dehydrogenase activities will result in electrochemical reactor moduls which can deliver enantio pure synthons for desired compounds in pharmaceutical or agrochemical applications. The obtained data will increase our knowledge on nanostructured catalysts and inorganic-organic hybrid systems. Cheap cofactor regeneration, easy product purification, high selectivity and avoidance of organic solvents will be the advantages of such processes to satisfy the

demands of green chemistry in respect of environmentally friendly, flexible and energy efficient productions.

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**NBR: 213600** **ACRONYM: M3-2S** **EC FUND: 3447883**

**DG:** RTD **Call: FP7-NMP-2007-SMALL-1** **Thema:** NMP-2007-2.5-2

**Title:** Multiscale Modelling for Multilayered Surface Systems

**Abstract:** It is recognised that more than 90% of failures in engineering components are surface related. Thus, a large variety of different multilayered surface systems (MSSs) with thickness ranging from nanometer to millimetre scales have been developed. However, the design of multilayered surfaces is normally based on experience and no currently available surface modelling technique can deal with MSSs. The aim of this programme is to address an urgent scientific, technological and market need for consistently reliable high performance MSSs, by developing generic, robust multiscale materials and process modelling techniques for the design, optimisation and performance prediction of MSSs. The S&T objectives are: (1) to develop molecular dynamics techniques to model atom deposition processes and the atomic structure and interfaces to achieve optimal coating microstructures; (2) to develop multiscale modelling and corresponding experimental techniques to determine nano and crystal behaviour of each layer of a surface coating and the macro behaviour of MSSs; (3) to develop an integrated multiscale modelling approach to link molecular dynamics (nano), crystal plasticity (micro) and continuum mechanics (macro) modelling activities for the applications; (4) to develop modelling techniques and software systems for design, processes and applications of multiscale MSS and (5) to develop modelling-based design methodology for optimised MSSs for high performance components aiming for improved lifetimes and reduced market lead time by 60%. The consortium consisting of 5 SMEs, 4 universities and 2 research organisations from 5 EU member states and 1 third country incorporates all the necessary elements for the research. Potential impact includes: economic impact - enhance the competitiveness of European coating specialists and manufacturers; eco-impact - reduced consumption of energy and materials and S&T impact - strengthen S&T excellence in modelling & surface engineering

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**NBR: 213631** **ACRONYM: NANOTHER** **EC FUND: 8408483**

**DG:** RTD **Call: FP7-NMP-2007-LARGE-1** **Thema:** NMP-2007-4.0-4

**Title:** Integration of Novel Nanoparticle based Technology for Therapeutics and Diagnosis of different types of Cancer

**Abstract:** The breakthrough objective of NANOTHER is to develop & characterise a novel nanoparticle system that will be used as a therapeutic agent or diagnosis tool for breast cancer, colorectal cancer & bone metastasis. Theranostics, the development of nanoparticles with both functionalities, will also be carried out using the hyperthermic effect to kill tumour cells or to release the selected drug . The nanoparticles used in NANOTHER will be selected based on previous studies. Therefore, only polymeric micelles core-shell nanoparticles and magnetic nanoparticles will be included in the study. The nanoparticles will be functionalised by attaching targeting molecules, depending on the type of cancer to be treated or diagnosed. Labels for diagnosis will include fluorescent or contrast phase probes, which will later be imaged and analysed with the appropriate equipment optimised during the project. Therapeutic agents will be loaded on to the nanoparticle, including drugs like doxorubicin, and new marine pharmacological compounds already in clinical trials. One of the most innovative aspects of this proposal is the use of siRNA as the therapeutic agent. The use of magnetic nanoparticles as a theranostic mechanism is also an innovative aspect of the proposal, as these nanoparticles can be activated to kill tumour cells detected depending on a positive or negative diagnostic. The project has been structured in seven different sub-projects including aspects like toxicology, biocompatibility of the nanodevices, and also efficacy and biodistribution of the system. In vitro (cellular models) & in vivo assays (small animals; mice) will be used for the study of diagnosis & therapy. The latter will be kept to the minimum necessary to study the efficiency & biodistribution and always taking into account the three Rs & national / EU norms. The NANOTHER consortium includes 18 top-level partners from 8 EU countries as the critical mass required to achieve ambitious project objectives.

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**NBR: 213651** **ACRONYM: STONECORE** **EC FUND: 2453300**

**DG:** RTD **Call: FP7-NMP-2007-SME-1** **Thema:** NMP-2007-4.0-6

**Title:** Stone conservation for the refurbishment of buildings

**Abstract:** STONECORE is a project dealing with the development and application of nano materials for consolidation and conservation of natural and artificial stone. Six SMEs, four universities, one public research organisation and one public body from seven countries have jointed together in order to find a new approach for refurbishment. The idea is to develop and test nano materials compatible to the components originally used during construction together with non destructive stone assessment methods. Colloidal sols of calcium hydroxide, calcium / barium carbonate, calcium sulphate or related compounds will be in the centre of interest. These materials will be used also as new, biozide free agents for mildew removal. The project will lead from laboratory investigations and small scale applications on trial areas to the use of the developed materials on selected real objects. It is a project that aims on knowledge based refurbishment of buildings as well as monuments of cultural heritage and that combines natural sciences and the art

of conservation. Thus, main subjects of STONECORE are: • The development of nano materials compatible to natural and artificial stone for refurbishment of buildings, monuments, fresco, plaster and mortar, • The development and test of suitable technologies for their application and • The development and test of non destructive assessment methods (such as georadar) in combination with traditional assessment methods (SEM, XRD, drilling resistance and other). The project will have duration of three years. The results will be presented to the public and interested companies in three workshops, in which interested parties are invited to test the developed materials and techniques on own objects. The project contributes to the EC objectives by the development of materials and technologies allowing a reduction of the material and energy consumption during refurbishment, creating new business opportunities for SMEs and protecting the cultural heritage.

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**NBR: 213669** **ACRONYM: ENSEMBLE** **EC FUND: 3899550**

**DG:** RTD **Call: FP7-NMP-2007-SMALL-1** **Thema:** NMP-2007-1.1-2

**Title:** ENgineered SElf-organized Multi-component structures with novel controllaBLe Electromagnetic functionalities

**Abstract:** Growth of eutectics is recognized as a paradigm for pattern-forming. Self-organised structures of size scales reaching down to submicron and nano scale regime emerge due to the interplay of chemical diffusion and capillarity. The fundamentally novel CONCEPT of the present proposal is to utilize - for the first time - the eutectic self-organisation mechanism for preparation of multi-component and multi-scale structures with controlled physicochemical and structural properties, with geometrical motifs capable of generating novel, predictable and controllable electromagnetic functionalities. This requires a deeper understanding of factors influencing eutectic self-organisation mechanism on a submicron/nanoscale. Accordingly, the main topic and activity of the present proposal is to generate new knowledge of the mechanism of eutectic self-organisation on this scale, by combining state-of-the-art experimental and modelling techniques. This new understanding of the underlying processes of eutectic self-organisation will then be used for the prediction and design of self-organised multi-component and multi-scale structures with controlled physicochemical and structural properties. This will be combined with the electromagnetic design of complex structures which can generate revolutionary electromagnetic functionalities. This will result in: a) the ability to predict the occurrence of patterns in eutectic systems, b) knowledge on how to design nanopatterned materials with controlled physicochemical and structural properties, c) methodologies to design and to fabricate self-organised multi-component and multi-scale structures with revolutionary electromagnetic functionalities, and d) the experimental realisation of these self-organised systems. The planned research is expected to open new horizons for utilizing self-organised structures in the

development of the next generation of materials for photonic application that will exhibit revolutionary properties.

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**NBR: 213706** **ACRONYM: SONODRUGS** **EC FUND: 10783900**

**DG:** RTD **Call: FP7-NMP-2007-LARGE-1** **Thema:** NMP-2007-4.0-4

**Title:** Image-controlled Ultrasound-induced Drug Delivery

**Abstract:** The demographic changes in Europe towards an aging society will coincide with increasing morbidity of the population. European citizens need improved access to state-of-the-art medical care especially in oncology and cardiology, while keeping expenditures on healthcare affordable. New therapeutic options such as externally triggered local drug release at the diseased area hold promise to solve urgent medical needs: improved treatment with reduced side effects, fewer burdens to the patient and faster recovery after intervention. Nanomedicine, the application of nanomaterials and nanotechnology to healthcare, will enable breakthroughs in clinical practice. SONODRUGS addresses clinical needs by developing novel drug delivery technologies for localised treatment of cardiovascular disease and cancer. SONODRUGS develops drug delivery concepts where drug release can be triggered by focused ultrasound induced pressure or temperature stimuli within the diseased tissue. New drug loaded nanocarriers will be designed for tailored drug delivery systems that respond to either of the two stimuli. Medical imaging, i.e. magnetic resonance imaging and ultrasound imaging, will be used to guide, follow and quantify the drug delivery process. Therapy efficacy using different drug delivery systems will be assessed in vitro and subsequently in preclinical studies. Starting form research on a broad range of materials and drugs, two nanocarriers will be finally selected, optimized and produced on a pilot scale in combination with image-guided delivery tools and methods. SONODRUGS binds expertise in materials research (Philips, TUE, GhentRGN, HBBG); material production (Nanobiotix, Lipoid); clinical knowledge in oncology (UTours, HBBG) and cardiology (UKB); in vitro and preclinical validation (UTours, ErasmusMC, UKB); research on imaging techniques (UCY, Philips, IMF); pharmacokinetics, toxicology and biodistribution (ULSOP, IPT).

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**NBR: 213717** **ACRONYM: SMW** **EC FUND: 2066150**

**DG:** RTD **Call: FP7-NMP-2007-SME-1** **Thema:** NMP-2007-1.2-2

**Title:** Single Molecule Workstation

**Abstract:** This proposal aims at the development and application of an innovative single molecule workstation, enabling advances in the research happening throughout Europe and the rest of the world around the investigation of living cells. By combining three most advanced microscopic techniques into a single workstation, we aim at reaching a new quality level in the study of the molecular biology of living cells. The proposed single molecule workstation will be composed of three key elements: (i) inverted light microscope (ILM); (ii) atomic force microscope (AFM); and (iii) optical tweezers (OT). A true virtue of this initiative is that by combining several ultra-sensitive microscopy techniques into a single workstation completely new horizons for molecular biology related studies are opened. The aim of this combined ILM-AFM-OT setup is to look at the surface topography using high-resolution AFM, to study the distribution of cellular molecules using high sensitive fluorescence and contrast enhanced light microscopy (ILM), and to measure molecular interaction forces with ultra-sensitive optical tweezers. As a complementary method, photo-thermal nano-spectroscopy (PTNS) will be used to investigate spectroscopic properties of cellular material with a spatial resolution down to sub-100 nm which will enable chemical analysis of sub-cellular components. The combined setup will provide a qualitatively new level in microscopic studies, giving unprecedented versatility in the detection and monitoring of cellular events with highest spatial and temporal resolution. The proposed single workstation will be used for the study of the correlation between structure and function of living cells with applications in immunology and cancer research.

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**NBR: 213927** **ACRONYM: STEPUP** **EC FUND: 3159200**

**DG:** RTD **Call: FP7-NMP-2007-SME-1** **Thema:** NMP-2007-3.4-1

**Title:** STEP UP IN POLYMER BASED RM PROCESSES

**Abstract:** An innovative mechano-chemical approach (based on the high energy ball milling) will be used for the development of innovative nanopolymers to be used in Rapid Manufacturing (RM) based on Selective Laser Sintering (SLS),by: 1.Structural modification (up nanopolymers stage) using a currently widely used polymer like Polyammide PA (a “nanoPA” will be produced); 2.Alloying (at nanoscale) with different polymers to tune mechanical properties; 3.Nanocharging of polymers (development of nanocomposites). Moving from this background, the project will make a real, LARGE, step up in polymers and composites properties by including nano features into the base materials and the final products. The final products will benefit from radically extended performances (i.e. operating temperatures, increased strength). In this way it will be possible, using existing prototyping machines, to realize freeform manufacturing technologies for the direct automated and customised production of parts and products from small to medium size batches for a wide range of possible applications (from vehicle applications to biomedical devices). The following are the project S/T objectives of SLS materials and parts produced using the modified PA -New nanostructured

materials based on Poliammides (PA) -Agglomerated (scale of 20-50 micron) nanophased (scale of 10-20 nm) particles suited for RM via SLS -Properties improvements in materials and RM/SLS parts properties (referred to conventional PA) of more than 200%. -Parts having improved properties and wider application window for automotive sector, consumer goods and medical instrumentation. For these reasons STEPUP responds quite well to the call topics by: introducing new concepts for the micro/nano fabrication (usage of nanoplymers); enabling transition of RM to customised solutions integrating materials design and simulations.

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**NBR: 213939** **ACRONYM: POCO** **EC FUND: 5524450**

**DG:** RTD **Call: FP7-NMP-2007-LARGE-1** **Thema:** NMP-2007-2.1-1

**Title:** Carbon Nanotube Confinement Strategies to Develop Novel Polymer Matrix Composites

**Abstract:** Light composite materials for load bearing applications can be made using different type reinforcements and polymer matrices. Carbon nanotubes (CNT) have been studied extensively because of their exceptional mechanical and electrical properties, yet their practical and extensive use in commercial materials is missing. The utilization of CNTs as reinforcement to design novel composites is a quite old idea. However, there is a lack of a knowledge based approach to achieve the nanostructuration level required to optimize the CNT/polymer composite performances. The main objective of POCO is to get innovative polymer composites filled with CNT in order to obtain nanostructured materials with tailor made properties. The CNT/polymer interface is, together with the CNT and the polymer, the third and most important element that will determine the final properties. Hence the chemical functionalization of CNT surfaces is of utter importance to achieve not only a proper dispersion and anchorage of the nanotubes into the polymer matrix during processing, but also to optimize the performance itself in solid state. Our approach involves the development of different CNT confinement strategies to develop novel polymer matrix nanocomposites. Several polymers have been selected as representative of thermosetting and thermoplastic materials. This ensures that the output of POCO could be applied in a wide range of applications: automotive, aeronautics, building, aerospace, wind power generation (blades), ship building, biomedicine…This project will be focused on four fundamental properties: (i) high strength for structural and mechanical components, (ii) tuneable electrical properties, (iii) low wear under fretting (low amplitude reciprocating movement) and (iv) superhydrophobicity. Multifunctionality of these materials will be an important benefit as the requirements for composite polymeric materials are quite diverse

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**NBR: 213948** **ACRONYM: NANODIRECT** **EC FUND: 3667067**

**DG:** RTD **Call: FP7-NMP-2007-SMALL-1** **Thema:** NMP-2007-1.1-2

**Title:** Toolbox for Directed and Controlled Self-Assembly of nano-Colloids

**Abstract:** The proposed research aims at developing a toolbox for direct self-assembly of nano-colloids. Different methods to drive and modulate self-assembly in nano-colloids will be developed, compared and evaluated. The toolbox will consist of the following elements : (i) Building blocks: model particles with varying shape, functionality and directional interactions will be synthesized (ii) Directing Tools : Electric and Flow fields, surfaces and interfaces (iii) Test and development methods : Experimental platforms adapted at nano-particle research and simulations methods, capable of dealing with a range of length scales. The proposal specifically aims to study these methods which are prone to scale-up The research consortium consists of leading groups in the filed of colloid science and engineering and soft matter research. The seeds of this toolbox are clearly present in the consortium including methods for production of model (field responsive) nanoparticles, unique experimental tools, theoretical skills and mesoscale simulation methods. The key idea is to gradually evolve in the research to be able to deal with smaller length scales and a wider range of directing fields .

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**NBR: 213969** **ACRONYM: CORONA** **EC FUND: 2999663**

**DG:** RTD **Call: FP7-NMP-2007-SMALL-1** **Thema:** NMP-2007-3.3-1

**Title:** Customer-Oriented Product Engineering of Micro and Nano Devices

**Abstract:** The competitiveness of EC companies in micro and nano technologies (MNT) very much relies on short time-to-market. That is true in particular for collaborative, distributed design and fabrication scenarios typical for an area where SMEs are strongly involved. Reduced time-to-market can only be achieved by faster product engineering. MNT product design and fabrication process development is an experimental task making use of key experiments or past experience to iteratively improve the engineering flow until a satisfying result has been reached. It is the objective of this project to contribute to ICT-based product engineering for MNT by: a) supporting integrated, distributed, multi-site product development with the customer in lead and control of the process, b) providing comprehensive and secure access to knowledge-bases for design and fabrication knowledge, c) offering ICT infra structure and tools needed to support customer services, design assistance and fab integration. The project work will provide contributions to: a) Developing a product engineering methodology and implementing it as a knowledge based, networked cooperation framework for customers, designers and manufacturers, b) Developing tools for an integrated design flow from the idea to the final product introducing tools to combine behaviour-oriented top-down and fabrication-oriented bottom-up design flows, c) Demonstrating the effectiveness of methodology and tools by realising example products. This work will contribute

innovations in integrated design and production methodologies, ICT to assist and partially automate concurrent layout and process flow design, and knowledge-bases for customer services and fab data exploration. The consortium includes companies, in part SMEs, and institutes that contribute experience in design methodology and tools for MNT, MNT production in various technological areas, and networking and dissemination activities for the European MNT-industries.

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**NBR: 213996** **ACRONYM: CORRAL** **EC FUND: 3376606**

**DG:** RTD **Call: FP7-NMP-2007-SMALL-1** **Thema:** NMP-2007-2.1-2

**Title:** Corrosion protection with perfect atomic layers

**Abstract:** The aim of this project is to develop high density defect-free ultra-thin sealing coatings with excellent barrier properties and improved corrosion resistance. Their successful functioning will be provided by the synergy of the coating “perfect” morphology and its complex structural design, which can be tailored at the nanoscale. The study will be focused on development of novel nanostructured coating systems, such as nanoscale multilayers, mixed and composite coatings. These impermeable sealing layers must be able to block the ion exchange between the substrate material and an aggressive environment, thus offering an efficient protection against corrosion over a long term. The coatings will be deposited by four alternative vapour deposition techniques, Filtered Cathodic Arc Deposition (FCAD), High Power Impulse Magnetron Sputtering (HIPIMS), Atomic Layer Deposition (ALD) and Plasma Enhanced Atomic layer Deposition (PEALD)). These techniques possess a unique advantage offering the deposition of highly conformal and uniform films of high density, free of defects. The technological objective of the project is to demonstrate the feasibility of corrosion protection by FCAD, HIPIMS and ALD techniques on an industrial scale. To fulfil this objective, a complete industrial process for the multi-stage surface treatment, including cleaning, pre-treatment, coating deposition, must be defined. All techniques will be evaluated in terms of technical effectiveness, production costs, environmental impact and safety, and the most suitable technique(s) will be selected for further development on a large scale for the applications in some targeted industrial sectors. The applications, tested within this project, concern high precision mechanical parts (bearings), aerospace components (break systems) and gas handling components. The coating application in the decorative and biomedical domains will be assessed.

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**NBR: 214030** **ACRONYM: CODICE** **EC FUND: 2700000**

**DG:** RTD **Call: FP7-NMP-2007-SMALL-1** **Thema:** NMP-2007-2.5-2

**Title:** COmputationally Driven design of Innovative CEment-based materials

**Abstract:** Albeit the C-S-H gel constitutes the main ingredient of cementitious skeletons and their life-service depends crucially on it, the possibility of tuning the intrinsic nature and properties of the C-S-H gel has been simply out of reach. Fortunately this long-standing impossibility can be currently overcome by the complementary action of new experimental capacities and stronger simulations schemes which explicitly pay attention to the nanoscale. Recent nanoindentation experiments have revealed that the C-S-H gel can present itself either in a low stiffness and low density variety (called LD C-S-H gel) or in a variety with a high stiffness and high density (called HD C-S-H gel). This dissimilar bearing capacity is indeed much more pronounced in their resistance to osteoporosis-like degradation processes (aging!). The question that arises is straightforward: Could the formation of the stronger and more durable HD C-S-H varieties be promoted against the LD- ones? CODICE aims to answer to this question by means of on-top-of-the-art simulations. In fact CODICE project aims to develop a serial parameter-passing multi-scale modelling scheme to predict the structural evolution and the mechanical performance of non-degraded and degraded cementitious matrices as a function of macroscopical processing variables to guide the design of cementitious materials in which the HD-C-S-H forms are promoted against the LD- C-S-H ones. Improvements of the mechanical properties about the 50 % and 600 % are envisaged for non-degraded and degraded cementitious scaffolds respectively, when compared to conventional designs. Thus, CODICE largely impacts on the competitiveness of the Construction sector, since the simulations 1) will offer an unbeatable and cheap solution to the cement sector to assess and improve the efficiency of cheaper cement formulations and 2) will computationally drive the design of cementitious materials with drastically lower maintenance costs.

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**NBR: 214032** **ACRONYM: NANOMAGDYE** **EC FUND: 2375108**

**DG:** RTD **Call: FP7-NMP-2007-SMALL-1** **Thema:** NMP-2007-2.2-2

**Title:** MAGNETIC NANOPARTICLES COMBINED WITH SUBMICRONIC BUBBLES AND DYE FOR ONCOLOGING IMAGING

**Abstract:** The objective of NANOMAGDYE consists in developing tailored biocompatible magneto-optical nanosystems based on magnetic iron oxide nanoparticles. The project will comprise the elaboration of the nanosystems and the characterisation of their structural, optical and magnetic properties. In vitro and in vivo tests will be carried out to test their biocompatibility. The combination of magnetic and optical properties will be achieved through hybrid nanoparticles made of a magnetic iron oxide core on which an organic layer (dye) will be grafted through a dendrimer molecule and a phosphate entity. This grafting strategy will be extended to bubbles on which magnetic nanoparticles will be attached. The grafting sites will be controlled in order to design

new geometries and architectures from rings up to submicronic magnetic spheres. Magnetic nanoparticles with monodisperse size between 2 and 100 nm will be elaborated in order to increase the possibility range of achieved properties. The opto-magnetic nanoparticles will be tested in a medical application and a dedicated magneto-optical probe will be fabricated. Current methods for labelling the lymph node system use a dye (vital blue) or radio nuclide injection detected through optical or Gamma probes, respectively, or a combination of both types of markers. Combining optical and magnetic labelling into a single biocompatible nanosystem will provide higher spatial resolution than presently and avoid using ionising radiation to improve patient safety and medical effectiveness. Stabilized submicronic bubbles labelled with the optical-magnetic nanoparticles will play the role of a contrast agent currently used in echography imaging and facilitate the uptake of the iron nanoparticle, and therefore improve node imaging.

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**NBR: 214042** **ACRONYM: FIBLYS** **EC FUND: 3408262**

**DG:** RTD **Call: FP7-NMP-2007-SME-1** **Thema:** NMP-2007-1.2-2

**Title:** Multi-functional Analytical Focussed ion beam tool for nanotechnology

**Abstract:** The project FIBLYS aims at developing an innovative nanostructuring, nanomanipulation and nanoanalysis instrument: a hybrid scanning probe (SPM) and dual beam focussed ion beam (FIB) instrument (including scanning electron microscopy (SEM) capabilities). In addition to an instrument based on conventional dual beam FIB(SEM) technology, an SPM/FIB(SEM) microscope will use both techniques, integrated in a compact setup offering capabilities that not only combine the techniques but allow for nanoanalysis and nanostructuring/-manipulation options that the single instrument or sequential use of the techniques is unable to achieve. This FIBLYS hybrid device will allow to use all FIB capabilities while imaging the procedures with the integrated SEM. The SEM has the options of chemical analysis through Energy Dispersive X-ray analysis (EDX) and structural analysis through Electron Backscatter diffraction (EBSD). The combination of SEM and SPM provides for the combination of nano-scale chemistry and crystallography imaging via electron-matter interactions (EDX, EBSD) with the information from tip-sample interactions like topography or magnetic/electrostatic force imaging. Combining electron-matter and tip-sample interactions, the FIBLYS hybrid instrument will for the first time allow to probe with nano-scale resolution many electron-matter interactions like detection of electron beam induced current (EBIC), or cathodoluminescence or phonons, or backscattered electrons directly at the surface with cantilever based sensors. This project will merge FIB(SEM) and SPM manufacturers at European level and reinforce their competitiveness. The partnership reflects the excellence and competences needed in this project, only possible through transnational co-operative research of six SMEs (SPM and FI(SEM) manufacturers, specialists in SPM and SEM

control, expertise in electron/ion optics, cantilever manufacturers for SPM techniques as well as three RTD performers.

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**NBR: 214095** **ACRONYM: HICAT** **EC FUND: 2647217**

**DG:** RTD **Call: FP7-NMP-2007-SMALL-1** **Thema:** NMP-2007-2.4-2

**Title:** Hierarchically Organized Metal Organic Catalysts for Continuous and Multi-batch Processes

**Abstract:** Hierarchically organised metal organic catalysts shall be developed which can be easily recycled in multi-batch processes or which can be used in continuous processes without loosing the original advantages of the corresponding homogeneous soluble metal organic catalysts - high selectivity, activity and stability. The catalysts will be constructed using components at the nano-scale in a bottom-up approach. Hereby, catalytically active metal complexes will be linked with nanoparticles such as polymeric microgels, hyperbranched polymers or hybrid systems consisting of silsesquioxanes attached to hyperbranched polymers. Further hierarchical organisation of HiCat catalysts will be accomplished by interconnected networks formed from the assemblies of catalytic nanoparticles using end-functional T-responsive polymers that can interact with functionalities on the surface of the nanoparticles as binding agents. Recycling of the catalyst-nanoparticle entities in multi-batch operation will be studied utilizing the change of solubility of the polymer supported catalysts by external stimuli. Based on polymer-nanoparticles linked by T-responsive polymers, new types of films and membranes with graded porosity can be prepared by varying the size of the nanoparticles and the length of T-sensitive polymers. This opens new opportunities for integration of catalytic steps and separation within the hierarchically structured system and, hence for continuous reactor operation. The proposal combines the superiority of homogeneous metal-organic catalysts often possessing nearly 100 % selectivity with the advantage of efficient separation by grabbing a new concept for building up hierarchically organised catalytic systems. Structural principles of tailor-made ligands will be transferred into tailor-made functional surfaces of nanoparticles. For proof of principle of the concept, three types of reactions will be studied: olefin metathesis, CX coupling and enantioselective hydrogenation.

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**NBR: 214107** **ACRONYM: NANOMAGMA** **EC FUND: 2963156**

**DG:** RTD **Call: FP7-NMP-2007-SMALL-1** **Thema:** NMP-2007-2.2-2

**Title:** NANOstructured active MAGneto-plasmonic MAterials

**Abstract:** The development of a novel concept of nanostructured material is involved in this project: the proper combination of magneto-optical (MO) and plasmonic elements to produce a magneto-plasmonic material tailored on the nanoscale. The novel magneto-plasmonic materials will offer the unique ability to control their properties in more than one way, since the magneto-optical activity will be affected by the alteration of the plasmonic characteristics and the optical response will depend on the magnetic ones. The latter puts an additional advantage over conventional materials, since the optical response can be actively tuned by means of an external agent: a magnetic field. The project has two main goals; the first is to prepare active magneto-plasmonic materials with tailored properties in the nanoscale and understanding the interactions of the magnetic properties with the plasmonic and optical ones, linked to electric charge oscillations. The second goal is to develop prototypes of applications that can benefit of this coupling. Since it is expected that the optical properties of these materials can be driven by using a magnetic field, this will allow designing and developing novel magneto-plasmonic devices. In particular, as a proof of the applicability of this concept, we will design, fabricate and test a prototype of a new kind of surface plasmon resonance (SPR) biosensor with MO elements, i.e. a surface magneto-plasmon resonance (SMPR) biosensor, comparing its performance against standard biosensors.

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**NBR: 214134** **ACRONYM: N2P** **EC FUND: 7400000**

**DG:** RTD **Call: FP7-NMP-2007-LARGE-1** **Thema:** NMP-2007-3.5-1

**Title:** FLEXIBLE PRODUCTION TECHNOLOGIES AND EQUIPMENT BASED ON ATMOSPHERIC PRESSURE PLASMA PROCESSING FOR 3D NANO STRUCTURED SURFACES

**Abstract:** Outstanding progress has been made in recent years in developing novel structures and applications for direct fabrication of 3D nanosurfaces. However, exploitation is limited by lack of suitable manufacturing technologies. In this project we will develop innovative in-line high throughput technologies based on atmospheric pressure surface and plasma technologies. The two identified approaches to direct 3D nanostructuring are etching for manufacturing of nanostructures tailored for specific applications, and coating. Major impact areas were selected, demonstrating different application fields. Impact Area 1 focuses on structures for solar cell surfaces. Nanostructured surfaces have the potential to improve efficiencies of cells by up to 25% (rel), having dramatic impact on commercial viability. Impact Area 2 focuses on biocidal surface structures. Increasing concerns about infections leading to the conclusion, that only multi-action approaches for control of infection transfer can be effective. We plan to combine such surfaces with 3D nanostructures, which will both immobilise and deactivate pathogenic organisms on surfaces. Impact Area 3 is the direct growth of aligned carbon nanotubes on electrode surfaces. The material is under investigation for use in high load capacitors which are seen as key components for energy storage systems, e.g. for Hybrid Electric Vehicle. Impact Area 4 focuses on tailored interfaces to achieve durable adhesion on polymer

surfaces by 3D nanostructuring and coating. Target is to reduce energy consumption by introducing lightweight materials. The N2P partners have been chosen to ensure a strong capability to exploit and disseminate the outcomes. Involved end-user industries represent high market value segments: photovoltaics, aeronautics, automotive, steel. The consortium includes 7 technology leading SMEs and 4 multi-national industries, cooperating with 9 institutes for industrial research and a public body from 8 European countries.

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**NBR: 214137** **ACRONYM: NANO3T** **EC FUND: 3726350**

**DG:** RTD **Call: FP7-NMP-2007-SMALL-1** **Thema:** NMP-2007-1.1-1

**Title:** Biofunctionalized Metal and Magnetic Nanoparticles for Targeted Tumor Therapy

**Abstract:** The cause of diseases is often unknown, but their origin can frequently be found at the biomolecular and cellular level situated on nm-scale. Early diagnostics combined with early intervention on that nanoscale is one of the holy grail of modern medicine. Inorganic nanoparticles are very promising agents in that respect. One of the promising biomedical applications of these nanoparticles is their use as agents for tumor hyperthermia. Hyperthermia is a form of cancer treatment that uses an elevated temperature to kill the tumor tissue. Compared to the more conventional surgical procedures, it is hailed as a less invasive approach that could be used for small, non-defined tumors. Well-designed instrumentation in combination with engineered inorganic nanoparticles that (a) possess the desired physical properties to generate a local heat and that (b) can specifically target the tumor offer immense potentials for targeted hyperthermia therapy. The overall objective of the present multi-disciplinary project is to develop and to explore various metal/magnetic nanoparticles as agents for targeted tumor therapy. To strive for this overall objective, a successful integration and convergence of different technologies at the nanoscale is indispensable. In this project, we will focus on the synthesis routes of tailor designed biofunctionalized nanoparticles for hyperthermia. This requires a profound physical and chemical characterization of the synthesized nanostructures, but the project is certainly not limited hereto. It will also include a toxicological and biological evaluation of the different nanoparticles. Hereby a detailed exploration and characterization of the interaction mechanism of the biological entities and the nanostructures will be pursued to obtain a better understanding of the phenomena occurring at the nanoscale. In addition, this project also comprises the design of advanced instrumentation that can be used for a controlled hyperthermia treatment.

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**NBR: 214148** **ACRONYM: NANCORE** **EC FUND: 5397297**

**DG:** RTD **Call: FP7-NMP-2007-LARGE-1** **Thema:** NMP-2007-2.1-1

**Title:** Microcellular nanocomposite for substitution of Balsa wood and PVC core material

**Abstract:** The project objective is to design a novel and cost-effective microcellular nanocomposite foam, with mechanical properties comparable to or better than Balsa wood and PVC foam, allowing for a substitution of these as core materials for lightweight composite sandwich structures. The material will be applicable for widespread industrial use, e.g. within Wind Power, rail, shipbuilding and automotive industries. The project addresses the call objective of developing polymer nanocomposites exhibiting radically enhanced properties and will involve scientific/technological tasks related to the development of microcellular nanocomposites, the structural scale of sandwich structures as well as the structural and mechanical analysis of the new material. Demonstration activities within the project will aim to validate the potential of the material for industrial use within different industries, with special emphasis on Wind Power through the full-scale static testing of a demonstrator blade.

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**NBR: 214249** **ACRONYM: NAPANIL** **EC FUND: 11800000**

**DG:** RTD **Call: FP7-NMP-2007-LARGE-1** **Thema:** NMP-2007-3.5-1

**Title:** Nanopatterning, Production and Applications based on Nanoimprinting Lithography

**Abstract:** The NaPANIL project aims to develop processes, materials and tools, both for manufacturing and for control, for truly 3-dimensional nanosurfaces with feature dimensions ranging from 50 nm to several µm. The nanosurfaces will be realised using various variants of nanoimprinting lithography. The dedicated application is to control light at nanostructured surfaces and a few potential high impact products have been identified by the end-user partners in the consortium. Design, demonstration and prototyping these applications will act as test-bench for the new manufacturing paradigm. The manufacturing processes possess generic aspects for production of any kind of topographically 3-dimensional nanostructured surfaces. In the R&D of nanoimprinting Europe has a leading position. The NaPANIL consortium combines the best expertise and know how in field to reach the goals in the project.

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**NBR: 214250** **ACRONYM: MDSPM** **EC FUND: 3022293**

**DG:** RTD **Call: FP7-NMP-2007-SME-1** **Thema:** NMP-2007-1.2-2

**Title:** Equipment and Methodology for Multi-Dimensional Scanning Probe Microscopy

**Abstract:** The ability to perform scanning tunnelling spectroscopy simultaneously with a measurement of the vertical and lateral tip-sample interaction force and energy dissipation on selected atomic or molecular sites is the next revolution in scanning probe microscopy and will revolutionise entire areas of surface science. The aim is to develop, manufacture and commercialise a new UHV low temperature multi-dimensional scanning probe microscope (MDSPM). The two dimensional force and energy dissipation measurement is performed via micro-fabricated cantilevers with relatively high spring constants (200-2000N/m) which are simultaneously driven on their flexural and torsional oscillation modes with sub-Angstroem amplitudes. The deflection sensing is achieved by a focussing Fabry-Perot sensor with an up to 100 MHz bandwidth and an unprecedented sensitivity down to 1 fm/sqrt (Hz). The high bandwith allows the detection of higher oscillation modes and harmonics. While high resonance frequencies are favourable to measure local energy dissipation processes arising from stochastic force fluctuations the detection of higher harmonics may be used to directly reconstruct the force field from a site-specific measurement performed at a selected surfaces site at one fixed tip-sample distance. The operation of the cantilever with ultrasmall amplitudes not only allows the direct measurement of the local force gradient but is ideal for scanning tunnelling spectroscopy with excellent signal-to-noise ratio necessitated by ultra-stable tip-sample positioning. These advances in scanning probe microscopy instrumentation will not only allow to imaging of metallic, semiconducting and insulating surfaces with unprecedented resolution, but will revolutionize our understanding of entire areas of surface science such as: chemical reaction dynamics, local energy dissipation and excitations, nanoscale contacts and a rational approach catalyst design, to name a few.

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**NBR: 214261** **ACRONYM: MUST** **EC FUND: 7143481**

**DG:** RTD **Call: FP7-NMP-2007-LARGE-1** **Thema:** NMP-2007-4.0-3

**Title:** MULTI-LEVEL PROTECTION OF MATERIALS FOR VEHICLES BY â€œSMARTâ€• NANOCONTAINERS

**Abstract:** The project MUST will provide new technologies based on active multi-level protective systems for future vehicle materials. “Smart” release nanocontainers will be developed and incorporated in commercial paints, lacquers and adhesive systems to prepare new products exhibiting self-healing properties. A multi-level self-healing approach will combine - in a same system - several damage prevention and reparation mechanisms, which will be activated in response to environmental conditions. The main objective of the project will cover design, development, testing and application of coated materials and adhesives used as novel multi-level protection systems for future vehicles. The new active protection systems will be based on different types of “smart” nanocontainers incorporated in polymer matrixes and adapted to the level of protection. These systems will result in a radical improvement of the long-term performance of metallic or polymer

substrates. To achieve the objectives, MUST has been configured in four main activities (WP): WP2 is divided in 6 sub-projects (SP) where SP1 is technology-oriented, and concerns the production of nanocontainers.SP2 and SP3 are directed to basic research, and consider fundamental studies on self-healing mechanisms and development of simulation models. SP4, 5 and 6 consider exploitation, costs and upscaling of the most promising systems in automotive, aerospace and maritime sectors, respectively. The demonstration of the technologies will be performed together with continuous risk management in WP3. WP4 also will manage dissemination of the results and training activities and WP1 will consider the whole coordination of the project. MUST will increase considerably the life cycle of materials and therefore boost the competitive strength of the European transport industry. The multi-level protection approach will also open opportunities for the application of new light materials (magnesium and aluminium alloys) in vehicle manufacturing.

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**NBR: 214281** **ACRONYM: NANOMMUNE** **EC FUND: 3358500**

**DG:** RTD **Call: FP7-NMP-2007-SMALL-1** **Thema:** NMP-2007-1.3-2

**Title:** Comprehensive assessment of hazardous effects of engineered nanomaterials on the immune system

**Abstract:** Engineered nanomaterials (ENs) present tremendous opportunities for industrial growth and development, and hold great promise for the enrichment of the lives of citizens, in medicine, electronics, and numerous other areas. However, there are considerable gaps in our knowledge concerning the potential hazardous effects of ENs on human health and the environment. Our EU-US partnership is committed to filling these knowledge gaps through a comprehensive assessment of ENs, with particular focus on effects on the immune system. The immune system is designed to respond to pathogens and foreign particles, and a core concept underpinning the current project is that the recognition versus non-recognition of ENs by immune-competent cells will determine the distribution as well as the toxicological potential of these materials. Our multidisciplinary consortium will focus on the procurement, synthesis and detailed physico-chemical characterization of representative categories of ENs, and the monitoring of potential hazardous effects using an array of in vitro and in vivo systems, as well as transcriptomic and oxidative lipidomic testing to determine specific nanotoxic profiles (signatures) of these materials. The final and integrative component of our research project is risk assessment of potential adverse effects of ENs on human health, and the dissemination of our findings. Through our comprehensive approach, which combines analytical procedures from many different disciplines and leading experts from several national institutes devoted to occupational and environmental safety, we aim to establish a panel of read-out systems for the prediction of the toxic potential of existing and emerging ENs, thus enabling a continuous and sustainable growth of the nanotechnologies. Overall, the results generated through this international program will

contribute to the understanding and mitigation of possible adverse effects of nanomaterials.

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**NBR: 214340** **ACRONYM: RESOLVE** **EC FUND: 2432960**

**DG:** RTD **Call: FP7-NMP-2007-SMALL-1** **Thema:** NMP-2007-1.1-2

**Title:** Bottom-up Resolution of Functional Enantiomers from Self-Organised Monolayers

**Abstract:** The high throughput identification of resolution systems for industrially important chiral chemicals will be approached using the bottom-up hierarchichal assembly from self-organised chirally nanostructured surfaces and the "Dutch resolution" family method to isolation of enantiomers. Molecular modelling, surface science, supramolecular chemistry and the critically important resolving library design will be used in synergy to develop systems which separate enantiomers and which can be patterned and miniaturised. The preparation of chiral surfaces and the knowledge of chiral discrimination phenomena at the nanoscale will be exploited to use them to template the formation of diastereomers, which in turn will lead to the formation of crystals (whose composition will be determined) containing pure enantiomers. The project's end goal is a rapid method for the identification of resolving systems for optically active compounds, and would constitute a leap forward for the area.

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**NBR: 214364** **ACRONYM: GALAXY** **EC FUND: 2900000**

**DG:** CNECT **Call: FP7-ICT-2007-1** **Thema:** ICT-2007.3.3

**Title:** GALS InterfAce for CompleX Digital SYstem Integration

**Abstract:** This project builds on a technology approach in which the EU currently has world leadership, thanks to previous pan-European funding, and in which the participants are recognised centres of excellence. We propose to provide an integrated GALS (Globally Asynchronous, Locally Synchronous) design flow, together with novel Network-on-Chip capabilities, that will materially aid embedded system design for a significant class of problems. We aim to remove existing barriers to the adoption of the technology by providing an interoperability framework between the existing open and commercial CAD tools that will support development of heterogeneous systems at the different levels of abstraction. The project will evaluate the ability of the GALS approach to solve system integration issues and, by implementing a complex wireless communication system on an advanced 45nm CMOS process, explore the low EMI properties, inherent low-power features and robustness to process variability problems in nanoscale geometries.

**NBR: 214371** **ACRONYM: NANOINTERFACE** **EC FUND: 3300000**

**DG:** RTD **Call: FP7-NMP-2007-SMALL-1** **Thema:** NMP-2007-2.5-2

**Title:** Knowledge-based multi-scale modelling of metal-oxide-polymer interface behaviour for micro- and nanoelectronics

**Abstract:** Micro- and nano-electronic components are multi-scale in nature, caused by the huge scale differences of the individual materials and components in these products. Consequently, product behaviour is becoming strongly dependent on material behaviour at the atomic scale. To prevent extensive trial-and-error based testing for new technology developments, new powerful quantitative knowledge-based modelling techniques are required. Current continuum-based finite element models rely intrinsically on extensive characterisation efforts to quantify the parameters present in these models ('top-down' approach). On the other hand, state-of-the-art models at atomic scale are able to describe the material behaviour at molecular level, but predictions at product scale are not feasible yet. Through direct coupling of molecular and continuum models, a multi-disciplinary approach in which experimentally validated multi-scale modelling methods will be developed in order to generate new materials and interfaces for System-in-Package (SiP) products with tailored properties and improved reliability within an industrial environment. In this approach, a user-friendly software tool will be realised which incorporates chemical, physical and electrical information from the atomic level into macroscopic models ('bottom-up' approach). Furthermore, new and efficient micro- and nano-scale measurement techniques are developed for obtaining detailed information about the most important phenomena at micro- and nano-scale and fast characterisation and qualification of SiPs. An additional important distinguishing part of this project is that, due to the composition of the consortium, the whole industrial development chain is covered: from material development, multi-scale models and experimental methods towards a fully functional commercial software package, ready to be used within an industrial environment.

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**NBR: 214407** **ACRONYM: APPLICMA** **EC FUND: 3341520**

**DG:** RTD **Call: FP7-NMP-2007-SMALL-1** **Thema:** NMP-2007-2.1-2

**Title:** Development of wear resistant coatings based on complex metallic alloys for functional applications

**Abstract:** The project aims at the development of a new type of coatings based on Complex Metallic Alloys (CMA). This is a family of ternary and quaternary alloys which exhibit

unexpected properties. The CMAs “Al61.5Cu25.3Fe12.2 B1” and “Al59.5Cu25.3Fe12.2 B3” consist only of metals, which show not metallic- but ceramic-like behaviour. Moreover, the bulk versions of these quasicrystals have proven outstanding properties as extremely low surface energy (wetting) and highest fretting wear resistance. The CMA AlMgB14 is known to be the hardest material after diamond. However, until now these outstanding properties could not be realised as coatings. First trials to develop coating processes were not successful, but showed reasonable concepts to solve the problems. The appliCMA project will focus on the development of PVD deposited coatings based on these three well-specified compositions. Following the mentioned outstanding properties of the three CMAs, the project is driven by applications for which they offer a remarkable step forward: tools for cutting, forming, extrusion dies, moulds for injection moulding, coated cooker’s oven for less sticking, fretting resistant coatings for aeroplanes, but also coatings of stamps for “Nano-Imprint-Technology (NIL)”. The project includes 9 researchers and 8 industries (including SME) in 8 member and associated state of the EU. They will deal with the fine tailoring of coatings and the processing of surface layers by PVD processes. Measurements of the micro/nano topography, electronic structure, phase transformations, microstructure and adhesion of the CMA coatings will be realized. The project will start with “lab samples” tested in lab facilities and will end with demonstrators tested in application related tests by end users. The project studies also fundamental mechanisms of the phase transitions in the manufacturing process of the targeted coatings, friction on these materials and simulation of friction in the forming applications.

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**NBR: 214469** **ACRONYM: ULTRAMAGNETRON** **EC FUND: 3147150**

**DG:** RTD **Call: FP7-NMP-2007-SMALL-1** **Thema:** NMP-2007-2.2-2

**Title:** Ultrafast All-Optical Magnetization Reversal for Magnetic Recording and Laser-Controlled Spintronics

**Abstract:** The aim of the proposed research is to develop “opto-nano-magnetism” as a novel approach for future magnetic recording and information processing technology at the junction of coherent nonlinear optics, nanophotonics and magnetism. In particular, we are aiming to investigate effects of light on magnetic order at the nanoscale, to obtain highly efficient and ultrafast (10-12 seconds and faster) optical control of nanomagnets and thus initiate a development of novel technology for unprecedented fast (THz) magnetic recording and information processing, including spintronics. To this aim we have formed a multi-disciplinary consortium of academic and industrial partners with complementary expertise in coherent nonlinear magneto-optics and ultrafast magnetization dynamics, spatially and time resolved magnetooptics, nanophotonics and X-ray nanoprobing of magnetism, atomistic simulations of subpicosecond magnetization dynamics for strongly nonequilibrium ensembles of spins, technology of magnetic nanostructures and their applications in spintronics. The project is directly relevant to

NMP-2007-2.2-2 Section of the NMP Work Programme (Nanostructured materials with tailored magnetic properties).

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**NBR: 214478** **ACRONYM: NANORETOX** **EC FUND: 3191900**

**DG:** RTD **Call: FP7-NMP-2007-SMALL-1** **Thema:** NMP-2007-1.3-2

**Title:** THE REACTIVITY AND TOXICITY OF ENGINEERED NANOPARTICLES: RISKS TO THE ENVIRONMENT AND HUMAN HEALTH

**Abstract:** NanoReTox will identify the potential risks to the environment and human health posed by free engineered (i.e. manmade) nanomaterial by comprehensively addressing five key questions: (1) How does the environment into which nanoparticles are released affect their physicochemical properties and their bioreactivity? (2) How does this impact on their ability to interact with and/or penetrate mammalian and aquatic cells and organisms (bioavailability) and will bioavailability result in toxicity? (3) Is there a pattern of cellular reactivity and/or toxicity related to physicochemical properties, i.e. a hierarchy of activity? (4) What combination of conditions discovered in (1-3) above are most likely to pose a risk to human health and the environment? (5) How can this information be incorporated in a risk assessment model? We have assembled a team of experts from across the EU and the US whose combined expertise can address these questions in depth, and therefore comprehensively cover the scope of research topic NMP-2007-1.3-2 – Risk assessment of engineered nanoparticles on health and the environment.

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**NBR: 214491** **ACRONYM: COTECH** **EC FUND: 6000000**

**DG:** RTD **Call: FP7-NMP-2007-LARGE-1** **Thema:** NMP-2007-3.5-2

**Title:** Converging technologies for micro systems manufacturing

**Abstract:** The objective of the project COTECH is to investigate new approaches of μ-manufacturing based on advanced technology convergence processes and to propose hybrid solutions for high added value cost effective μ-manufacturing emerging applications. The main goals of COTECH are to develop: (1) μ-replication technologies underpinned by emerging tool-making technologies for processing multi-material components and creating: a) 3D μ-components using high throughput multi-material μ-injection moulding with sub-μm resolution; b) 2D μ-components using direct multi-material hot or UV embossing with a sub-200nm resolution. (2) Radically new replication convergent technologies combining the capabilities of μ-injection or embossing to a complementary activation step to create intelligent devices in a single process step: a)

Hybrid processes based on μ-injection moulding using modules of e.g coating and compression injection moulding, to provide functionality to μ-devices, such as active coatings and combination of micro and nano features in a single step; b) Ultimately the hybrid processes based on μ-injection with embossing will be validated. This will offer a very high throughput multimaterial μ-injection that will enable the fabrication of 3D high aspect ratio μ-parts, complemented by an embossing step to allow ultra precise 2D features. (3) Global process chains with increased MTBF (50%) and fabrication of high quality products. This requires innovative non-destructive inspection solutions and simulation models. (4) High added value μ-devices with advanced functionalities. COTECH proposes to validate industrially the new technology convergence processes with 8 demonstrators representing the most emergent industrial sectors (transport, biomedical, energy). The expected market for the industry exceeds 1 Billion €. COTECH will also address the problem of knowledge fragmentation by activating a polymer μ-manufacturing sub-platform as support to MINAM.

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**NBR: 214499** **ACRONYM: NAMASTE** **EC FUND: 2299963**

**DG:** RTD **Call: FP7-NMP-2007-SMALL-1** **Thema:** NMP-2007-2.2-2

**Title:** Nanostructured Magnetic Materials for Nanospintronics

**Abstract:** We are proposing a Collaborative Project, NAMASTE, on nanostructured dilute magnetic semiconductor and metal materials. The key ideas are to control and manipulate the nanoscale properties of magnetic materials by local strain and electric fields making possible new types of magneto-electronic and spintronic devices. This is a co-ordinated programme of theoretical, experimental and technological research by a consortium of European academic and industrial research groups, each of which is internationally leading in the complementary, multidisciplinary research fields essential to the project delivery. The proposal builds on recent advances in the state-of-the-art by the consortium members and is based on the design of materials whose specific nanostructure yields the required tailored properties. NAMASTE should significantly advance the understanding of nanostructured magnetic materials and magnetic phenomena at the nanoscale. The project has a high probability of major medium and long term impact on many aspects of spintronics, magnetic data storage and processing, and magnetic sensors.

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**NBR: 214538** **ACRONYM: BISNES** **EC FUND: 2876280**

**DG:** RTD **Call: FP7-NMP-2007-SMALL-1** **Thema:** NMP-2007-1.1-1

**Title:** Bio-Inspired Self-assembled Nano-Enabled Surfaces

**Abstract:** Advanced nanofabrication can produce now nano-structures similar in size with single biomolecules or their self-assembled architectures. Capitalising on this strategic opportunity, BISNES focuses on the design, fabrication and implementation of biomimetic nanostructures which complement biomolecular surfaces and modulate the biomolecular activity. The BISNES project will (i) develop software products for the representation and quantification of bimolecular surfaces, especially those that self-assemble in long-range nano-aggregates, interacting with artificial nanostructures; (ii) design and fabricate nanostructured surfaces and objects that complementary replicate biomolecular surfaces; and (iii) design, fabricate and implement novel hybrid bio-devices which exhibit quantum-leap increase in capabilities (e.g., sensitivity, response time, cost) or entirely new ones. The project will deliver demonstrated technical solutions with impact on a wide range of applications and products: ultra-sensitive bio-diagnostics and drug discovery devices; inherently bactericidal surfaces, medical devices for the in vitro study of amyloid and cytoskeleton proteins central to critical disease (e.g., neurodegenerative diseases, cancer); and hybrid nanodevices that exhibit new electromagnetic properties useful for future IT devices. The research consortium has the critical mass of knowledge and experimental capabilities, as well as the right combination of activities (academia and industry, both SMEs and industry end-user), which allows us to follow the complete innovation path from fundamental science to its implementation in demonstration devices. BISNES' cross-disciplinary approach of will synergise the European first-class position in nanofabrication and biomolecular engineering, through cross-field applications and will contribute to the consolidation of the high added-value of European biomedical, advanced manufacturing and IT industry.

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**NBR: 214539** **ACRONYM: BIOSCENT** **EC FUND: 6305731**

**DG:** RTD **Call: FP7-NMP-2007-LARGE-1** **Thema:** NMP-2007-2.3-1

**Title:** BIOactive highly porous and injectable Scaffolds controlling stem cell recruitment, proliferation and differentiation and enabling angiogenesis for Cardiovascular ENgineered Tissues

**Abstract:** Congenital and acquired diseases of the heart are the leading causes of morbidity and mortality in the world today; 7.2 million people die each year due to coronary heart disease, being the first cause of mortality in population above 60 years old, and the second cause after HIV in world wide young population. There is an urgent demand for new methods to repair and replace damaged cardiovascular tissues. One of the most promising ways to achieve this goal is the development of regenerative therapies aided with novel intelligent nanobiomaterials such as bioactive scaffolds. The overall objective of this project is the development of innovative bioactive polymeric scaffolds able to guide tissue formation from dissociated stem cells, for engineering autologous

cardiovascular replacements, namely vascular tissues, heart valves and cardiac muscle. Two different strategies will be followed to approach creating new engineered tissue:
1.In vitro tissue engineering: according to the most frequent tissue engineering paradigm, cells will be seeded on a scaffold composed of synthetic polymer or natural material and the tissue will be matured in vitro in a bioreactor, in order to obtain a construct that can be implanted in the appropriate anatomic location as a prosthesis;
2.In vivo tissue engineering: unseeded scaffolds that attract endogenous cells and control cell proliferation and differentiation will be implanted to repopulate and remodel an altered cardiovascular tissue. The strong innovative content of the project is in the realisation of multifunctional scaffolds which can guide complex cellular processes such as adhesion, proliferation and differentiation, processes fundamental for tissue regeneration. It is therefore necessary to design integrated material scaffolds and culture environments, which can appropriately confer biochemical, morphological, electrical and mechanical stimuli to a developing tissue.

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**NBR: 214547** **ACRONYM: NEURONANO** **EC FUND: 2498000**

**DG:** RTD **Call: FP7-NMP-2007-SMALL-1** **Thema:** NMP-2007-1.3-2

**Title:** Do nanoparticles induce neurodegenerative diseases? Understanding the origin of reactive oxidative species and protein aggregation and mis-folding phenomena in the presence of nanoparticles

**Abstract:** As the use of nanoparticles becomes more prevalent, it is clear that human exposure will inevitably increase. Considering the rapidly ageing European population and the resulting increase in the incidence of neurodegenerative diseases, there is an urgent need to address the risk presented by nanoparticles towards neurodegenerative diseases. It is believed that nanoparticles can pass through the blood-brain barrier. Once in the brain, nanoparticles have two potential major effects. They can induce oxidative activity (production of Reactive Oxygen Species), and can induce anomalous protein aggregation behaviour (fibrillation). There are multiple disease targets for the nanoparticles, including all of the known fibrillation diseases (e.g. Alzheimer's and Parkinson's diseases). The factors that determine which nanoparticles enter the brain are not known. Nanoparticle size, shape, rigidity and composition are considered important, and under physiological conditions, the nature of the adsorbed biomolecule corona (proteins, lipids etc.) determines the biological responses. The NeuroNano project will investigate the detailed mechanisms of nanoparticle passage through the blood-brain barrier using primary cell co-cultures and animal studies. Using nanoparticles that are shown to reach the brain, we will determine the mechanisms of ROS production and protein fibrillation, using state-of-the-art approaches such as redox proteomics and isolation/characterisation of the critical pre-fibrillar species. Animal models for Alzheimer's diseases will confirm the effects of the nanoparticles in vivo. At all stages the exact nature of the nanoparticle biomolecule corona will be determined.

The result will be a risk-assessment framework for assessing the safety of nanoparticles towards neurodegenerative diseases, based on the connection of their biological effects to their biomolecule corona, which determines the biological response in vivo and reports on the nanoparticles' history.

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**NBR: 214566** **ACRONYM: NANOSCALE** **EC FUND: 3030405**

**DG:** RTD **Call: FP7-NMP-2007-SMALL-1** **Thema:** NMP-2007-1.1-1

**Title:** Understanding interactions between cells and nanopatterned surfaces.

**Abstract:** The study of biological processes occurring at the nanoscale is becoming a new discipline at the border between Physics and Biology with major scientific challenges and new technological applications. In fact, interactions at the nanoscale between cells/neurons and surfaces with specific nanopatterns appear to control several major biological processes, such as cell proliferation and differentiation. The aim of the present NanoScale proposal is therefore to explore interactions between stem cells, neurons, neuronal networks and surfaces with specific geometrical nanopatterns and nanoprints of specific proteins and molecules. In order to do so, we have formed an interdisciplinary consortium consisting of five major European research centres (SISSA, TASC-INFM, DTU, NMI and ENS) with two SMEs (MCS, Promoscience) gathering biological knowledge and expertise in the fabrication of nanostructures and of their manipulation. The NanoScale proposal will produce and develop a variety of nanodevices for growing, guiding, manipulating cells, neurons and neuronal cultures. It is composed of two major ingredients: i - the combination of a MicroElectrode Arrays (MEAs) with chemical and topographic micro/nanosubstrates controlling the network growth; ii – the coupling with external measuring and/or manipulating devices such as Electron Microscopes and Optical Tweezers. We expect to provide an answer to new scientific issues and therefore achieving major scientific breakthroughs. In addition, our proposal will produce new knowledge and know-how enabling the development of new marketable products that will be commercialised by MCS.

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**NBR: 214579** **ACRONYM: DUALLOGIC** **EC FUND: 5799338**

**DG:** CNECT **Call: FP7-ICT-2007-1** **Thema:** ICT-2007.3.1

**Title:** Dual-channel CMOS for (sub)-22 nm high performance logic

**Abstract:** We propose to develop for the first time a dual-channel CMOS technology comprising high channel mobility (high-μ) Ge pMOS and III-V compound semiconductor nMOS transistors co-integrated on the same complex engineered substrate on Si. This offers a

high performance booster as an option for the 22 nm technology creating competitive advantage for the European nanoelectronics industry. In addition, high-μ dual channel CMOS could be the main new introduction in sub-22 nm nodes in agreement with the strategic planning of the ENIAC technology platform. The project will develop the full set of FEOL modules from the starting local GeOI substrate to the dual-channel engineered substrate, the high-k/metal gate stacks and the S/D junctions with low resistivity contacts. Our aim is to use surface inversion channels and a self-aligned process with implanted S/D contacts for both III-V and Ge MOSFETs to ensure compatibility with the scaling and operation rules of CMOS. Device modelling and circuit design will assist in selecting the most suitable device architecture. The technology will be validated by the successful co-integration of short channel functional transistors using a 65 nm/200 mm pilot semiconductor processing line. This will allow characterization in terms of mobility at short gate lengths and identification of possible showstoppers associated with the behavior of high-μ channels at nanoscale dimensions. In addition, using toolsets, process flows and know how similar to Si, we aim at demonstrating that the high-μ dual channel technology is scalable and manufacturable without the need for introducing costly and disruptive technologies, thus ensuring the CMOS evolution for next generations. Mobilizing major technology development laboratories in Europe along with leading semiconductor and information technology industry and key semiconductor equipment manufacturers, this project can be a catalyst to the effort for maintaining competence in manufacturing and IP in Europe

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**NBR: 214627** **ACRONYM: DYNACOP** **EC FUND: 3493688**

**DG:** REA **Call: FP7-PEOPLE-2007-1-1-ITN** **Thema:** PEOPLE-2007-1-1-ITN

**Title:** DYNamics of Architecturally COmplex Polymers

**Abstract:** The scientific objective of DYNACOP is to obtain a fundamental understanding of the flow behaviour and the dynamics of blends of topologically complex macromolecular fluids and their role in processing and properties of blends. These materials exhibit complex dynamics and rheology and, in many cases, show hierarchical relaxation over many different timescales. This in turn affects the processing and properties of the final materials. In order to rationally design appropriate materials and processes for various technological applications, a rigorous, knowledge based approach is needed. This is especially urgent in the face of current opportunities offered by tailored molecular engineering of polymers at the industrial scale, and the proposed use of these materials in nano-structured composites for smart applications in devices, electronics ad high-performance applications. The training objective of the proposed action is to provide young post-doctoral researchers with the necessary interdisciplinary knowledge and experience in the field of soft materials properties, much needed throughout Europe, which will allow them to address some of the many scientific and technological challenges in the field. This will first and foremost be achieved through a collaborative

research program and portfolio of training courses intimately linking industry and academia. To ensure fruitful collaborations, the participating research groups will work around a limited number of model systems; exchange the samples, and apply to them the techniques and/ or theoretical approaches developed in the different laboratories. The research groups are selected in order to obtain the needed synergy, as they have different backgrounds/expertise, in physics, chemical engineering, chemistry and materials science. 6 Very high profile international visiting scientists, bringing their uniques expertise to Europe, will participate in the training and research.

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**NBR: 214653** **ACRONYM: SURFUNCELL** **EC FUND: 5472795**

**DG:** RTD **Call: FP7-NMP-2007-LARGE-1** **Thema:** NMP-2007-2.1-1

**Title:** Surface functionalisation of cellulose matrices using cellulose embedded nano-particles

**Abstract:** The projects main R&T objective is to create new, smart and bio-based surface nanostructured polymer composites showing exceptional surface functionality (mechanical, chemical, selective interaction properties). These new materials will be composed of nano-scaled polysaccharides layers with embedded nano-particles, coating different celluloses matrices. The compounding is restricted to the biopolymers surface and outer layers, providing the “filler” to the area where it is required and avoiding the deterioration of the matrix materials mechanical properties. The project will investigate these new effects - cellulose dissolution, structuration with nano-particles and irreversible coating – will develop their understanding and mastering and exploit their applicability. Several routes will be opened to prepare a completely new class of high-value biobased materials with tailored functions and properties applicable in many different fields: • Separation technologies: providing selective interaction properties tuneable by environmental properties • Technical fibres and foils: Specific surface modifications (strength, abrasion, thermal and chemical stability, hydrophilicity/hydrophobicity …) • Improved properties as flame resistance, conductivity, antimicrobial activity, barrier properties • Medical and hygienic devices: Formation of depots for humidity, drugs (controlled release), antimicrobial compounds. • Sensors, displays, electronic devices: performing structural changes under the influence of an external field. The project will have impact to Nanoscience by the development of knowledge and new strategies to handle nanoparticles and to design multifunctional nanostructured composite materials based on renewable resources. Nanotechnology by the development of technologies to design new materials based on the elaborated scientifice knowledge.

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**NBR: 214660** **ACRONYM: SUSTAINCOMP** **EC FUND: 6500000**

**DG:** RTD **Call: FP7-NMP-2007-LARGE-1** **Thema:** NMP-2007-4.0-1

**Title:** Development of Sustainable Composite Materials

**Abstract:** The SustainComp project aims at the development of a series of completely new wood-based sustainable composite materials for use in a wide array of market sectors, ranging from the medical, transportation and packaging to the construction sector. A primary goal is to substitute fossil-based materials used in these sectors. The performance of today's biocomposite materials is not sufficient for a range of applications. The approach is to better utilize the inherent properties of cellulosic fibres and nanocellulose fibrils in such materials. The project encompasses the whole chain from production of modified fibres and nanocellulose through compounding and moulding to the final ecodesigned product for a number of product families. These new materials will integrate today's large enterprises on the raw material and end-use sides (e.g. pulp mills and packaging manufacturers) and small and medium sized enterprises on the composite processing side (e.g. compounders and composite manufacturers). It is envisioned that this will help the transformation of the traditional Forest Products Industry to more highly value added materials through the adaption of a set of advanced technologies such as the production of nanocellulose in larger scale, tailoring of fibres and nanocellulose, wet commingling, nanostructuring, layer by layer deposition and fibre spinning using nanocellulose fibrils. More specifically the objective is to demonstrate new products within the following product families: i) Nano-reinforced foams (to replace styrofoams in the packaging and construction sector) ii) Moulded type of compounds, to introduce cellulose reinforced renewable biocomposites in the transportation and construction sectors iii) High throughput nanostructured membranes with designed selectivity for small-scale liquid applications in the medical field to large scale municipal applications This project conforms to the envisioned composite program in the Forest Technology Platform.

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**NBR: 214666** **ACRONYM: ASMENA** **EC FUND: 3940098**

**DG:** RTD **Call: FP7-NMP-2007-SMALL-1** **Thema:** NMP-2007-1.1-1

**Title:** Functional assays for membrane protein on nanostructured supports

**Abstract:** More than 50% of all drug targets are membrane proteins; new research tools to screen function of membrane drug targets are therefore expected to open up new avenues for original drug development. The proposed project addresses the need of the pharmaceutical industry for new technologies for reliable and efficient screening of membrane proteins as drug targets. Most critical current aspects of membrane protein assays are (a) the lack of reliable procedures to immobilize membrane proteins on sensor surfaces in a format suitable for label-free high-throughput screening of drug candidates; (b) the need for downscaling assay formats to accelerate functional

screening; and (c) the feasibility of reading out the diverse functions of membrane proteins. The partners – with highly complementary expertise and experience of working together – will develop platforms for functional membrane protein assays by integration of the most recently gained knowledge and techniques. The key concepts of the platforms include (a) exploitation of nanoporous substrates to enhance the stability of supported proteolipid membranes and their integration in a sensor chip format; (b) nanoscale surface modifications for directed self-assembly of proteolipid structures on chip; and (c) self-assembly of proteolipid membranes onto nano-sized sensor structures from proteoliposomes, and demonstration of the functionality in quantitative drug candidate screening assays suitable for commercial applications. The project is expected to make a substantial contribution to (a) improved understanding of lipid membrane and membrane protein interaction with designed nanoenvironments; (b) development of prototype products and intellectual property related to membrane protein sorting and handling; (c) new compounds for functionalization of biosensor applications; (d) cost-effective array-based concepts for nanoplasmonic and electrochemical sensing; and (e) functional assays for membrane protein drug targets.

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**NBR: 214685** **ACRONYM: MAGISTER** **EC FUND: 8278091**

**DG:** RTD **Call: FP7-NMP-2007-LARGE-1** **Thema:** NMP-2007-2.3-1

**Title:** Magnetic Scaffolds for in vivo Tissue Engineering

**Abstract:** The main driving idea of the project is the creation of conceptually new type of scaffolds able to be manipulated in situ by means of magnetic forces. This approach is expected to generate scaffolds with such characteristics as multiple use and possibly multipurpose delivery in order to repair large bone defects and ostheocondral lesions in the articular surface of the skeletal system. The major limitations of the scaffolds for bone and cartilage regeneration nowadays available in the market are related to the difficulties in controlling cell differentiation and angiogenesis processes and to obtain stable scaffold implantation in the pathological site. . . Several attempts have been performed over the last years in order to provide scaffolds for tissue engineering, but nowadays there is no way to grant that tissue regeneration take place in the pathological site. The provision in vivo of the scaffold with staminal cells or /and growth factors in order to drive the tissue differentiation process and parallel angiogenesis represents nowadays one of most challenging requests [Ref. Nanomedicine roadmap]. The Consortium aims to elaborate, investigate and fabricate new kind of scaffolds – magnetic scaffolds (MagS) - characterized by strongly enhanced control and efficiency of the tissue regeneration and angiogenic processes. The magnetic moment of the scaffolds enables them with a fascinating possibility of being continuously controlled and reloaded from external supervising center with all needed scaffold materials and various active factors (AF). Such a magnetic scaffold can be imagined as a fixed “station” that offers a long-living

assistance to the tissue engineering, providing thus a unique possibility to adjust the scaffold activity to the personal needs of the patient.

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**NBR: 214706** **ACRONYM: EXCELL** **EC FUND: 3780750**

**DG:** RTD **Call: FP7-NMP-2007-SMALL-1** **Thema:** NMP-2007-1.1-1

**Title:** Exploring Cellular Dynamics at Nanoscale

**Abstract:** EXCELL is a novel innovative approach to explore interaction mechanisms between biological materials and systems/nanostructures. It involves a forward-looking cross-disciplinary and design-based research to generate an integrated, biologically inspired technological platform of high complexity, able to monitor cell dynamics at nano-scale. Expertise in cellular and molecular biology, nanosciences, material engineering, biophysics, biotechnology, modelling, and analytical chemistry, are combined to address the targeted goals, which go beyond the state of the art methods used in traditional biotechnology and systems biology. EXCELL will provide a complete Lab-in-a-Cell (LIC) sensor and actuator platform, which is capable of: (1) studying single cells in their natural environment surrounded by other cells or a complex mixture of different cells/tissue, (2) following the dynamics and interdependence of single cell processes from gene, protein, metabolite to compound secretion, exocytosis and cell-to-cell communication, (3) testing how and where various stimuli affect the different levels of the molecular machinery and finally (4) programming cells to be able to differentiate into a particular phenotype. A major task is the design of suitable biocompatible nano/bio interfaces that ensures a sustainable cellular environment. EXCELL provides a unique opportunity for developing advanced, novel experimental tools to address fundamental problems of stem cell research and poses a potential for possible diversification and modulation of developmental programs of stem cells to differentiate them into specific phenotypes. EXCELL has the capacity to drive new discoveries having a significant impact not only in the field of stem cell research and clinical use, but also on molecular engineering, nanosciences, sensor development, diagnostics, therapeutics, biotechnology and industry (smart materials, medical diagnostics, pharmaceutical companies, start-ups)

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**NBR: 214810** **ACRONYM: FANTOMAS** **EC FUND: 3057350**

**DG:** REA **Call: FP7-PEOPLE-2007-1-1-ITN** **Thema:** PEOPLE-2007-1-1-ITN

**Title:** Femtosecond opto-magnetism and novel approaches to ultrafast magnetismat the nanoscale

**Abstract:** The aim of this proposal is to create a training network in the newly-emerging multidisciplinary field of “nano-opto-magnetism”, a new scientific area with novel technological opportunities at the junction of coherent nonlinear optics, nanoscience and magnetism. The impact on society of this newly emerging field is potentially very high, therefore it is decisive that now young researchers are trained and equipped, so that they can become future leaders. We aim at achieving this by an integrated combination of a high-quality training program and their direct involvement in front-line research. In the research program we want to investigate nonthermal effects of light on nanomagnets in order to obtain a comprehensive understanding of physical mechanisms leading to a highly efficient ultrafast (10-12 seconds and faster) optical control of magnetism at the nanoscale. Such scientific breakthroughs are expected to develop novel technology for unprecedented fast (THz) opto-magnetic recording. A high-level training program firmly embedded in a consortium of both academic and industrial partners is designed to create a unique training environment to educate a new generation of young researchers in this interdisciplinary, recently emerging area of nano-opto-magnetism. In order to advance the young researchers career development, the industrial relevance of this research as well as the involvement of industrial partners is fully exploited. In addition to the scientific and networking training, this offers unique opportunities for training of complementary skills of the fellows such as training in intellectual property rights, patent writing, commercial exploitation of the results and research-and-development policy.

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**NBR: 214814** **ACRONYM: AMON-RA** **EC FUND: 3199987**

**DG:** RTD **Call: FP7-NMP-2007-SMALL-1** **Thema:** NMP-2007-2.2-3

**Title:** Architectures, Materials, and One-dimensional Nanowires for Photovoltaics - Research and Applications

**Abstract:** The proposed project AMON-RA (Architectures, Materials, and One-dimensional Nanowires for Photovoltaics – Research and Applications) is intended to result in a new type of solar cell, combining advanced hetero- and nano-structures with silicon photovoltaic technology. By ap-plying state-of-the-art photovoltaics design to semiconductor nanowires and nanotrees and assisted by tailor-made theoretical modeling and advanced processing, we aim to demonstrate high-efficiency multi-junction photovoltaic cells made from previously impossible materials combinations. The high degree of self-assembly and insensitivity to lattice parameters inherent in the nanowire growth process will also make it possible to produce such cell relatively cheaply and on inexpensive silicon substrates. In AMON-RA, we will also evaluate the solar cell designs on a systems level, with special attention to future industrialization and upscaling.

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**NBR: 214832** **ACRONYM: SUPERLION** **EC FUND: 2800000**

**DG:** RTD **Call: FP7-NMP-2007-SMALL-1** **Thema:** NMP-2007-2.2-3

**Title:** Superior Energy and Power Density Li-Ion Microbatteries

**Abstract:** On-board microbattery power is fast becoming essential in many of today's emerging technologies. Down-scaling in the micro-electronic industry has far outpaced advances in small-scale electrical power supplies. The absence of on-board power is a hinder to advances in many critical areas: micro-electronic devices and biomedical micro-machines. However, nano-materials and -structures provide new resources to attack the problem. MEMS devices will change our lives completely - given micropower sources. These include microsensor arrays, micro-vehicles, identification cards, memory backup, and biomedical micro-machines (pacemakers, defibrillators, neural stimulators, drug delivery systems). Insufficient power from 2D-MB configurations inspires this search for a 3D-MB using cheap and light micro-/nano-fabrication materials. We also probe whether related techniques can improve the performance of conventional Li-ion batteries. Can multicomponent assembly be replaced by a single interpenetrating nano-architectured anode/cathode element separated by an electrolyte? This would greatly cheapen conventional rechargeable Li-ion batteries for typically EV/HEV applications. Our major objectives are: • Synthesis and fabrication of novel nano-architectured battery materials and MB components. • Implementation in fully integrated thin-film 3D-MBs with current and power densities per unit footprint area of 70-100 µAh and 150-200 µW for 50-100 reversible cycles. • Implementation of at least some of these 3D-MB concepts in conventional normal-scale Li-ion battery fabrication. • "Proof-of-concept" by showing that some 3D-MB device from the project can power both a MEMS and a medical device. The project thus establishes 3D nano-architectures, micro-/nano-fabrication approaches, and the enabling Science for a whole new generation of microbatteries.

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**NBR: 214840** **ACRONYM: NANODNASEQUENCING** **EC FUND: 2170925**

**DG:** RTD **Call: FP7-NMP-2007-SMALL-1** **Thema:** NMP-2007-1.1-1

**Title:** NanoTools for Ultra Fast DNA Sequencing

**Abstract:** The demand for a next-generation of technologies for DNA sequencing that will provide fast and affordable DNA decoding is pressing. Present bio-chemical schemes are time consuming and expensive, thus cheap and fast alternatives for DNA "reading" are of great need. This is now internationally recognized. For example, the US NIH recently awarded 40M$ in grants overpiloting projects to spur development of these innovative technologies. The goal of this project is to investigate a novel single-molecule DNA se-

quencing nanotechnology protocol (gene sequencer) that has potential to sequence a molecule of genomic dimensions in hours without expensive and fault sensitive DNA copying steps and chemical reactions. The gene sequencer is based on the electrical characterization of individual nucleo-bases, while DNA passes through a nanopore with integrated nanotube side-electrodes. The research proposed here will provide a unique combina-tion of state of the art capabilities for cutting and usage of single wall carbon nanotubes as electrodes forming a lithographically fabricated “nanogap” with single-nanometer precision. In addition, the synergy of consortium resources for electrical characterization and leading theoretical skills for nanotransport will provide new solutions and information for an answer on the proof-of-principle question: is it possible to detect different types of DNA bases by their electrical properties? The overall objective of our collaborative research is to develop cheap and high-speed DNA sequencing technology. This will be achieved trough the following steps: 1. Fabrication of single wall carbon nanotube junction-gate for molecular recognition; 2. Exploring the interaction and conduction mechanisms between DNA and nanotube-electrode and DNA-nanopore; 3. Electrical characterization of the DNA nucleobases; 4. Development of model nano-electronic device for single-base DNA electrical characterization and decoding.

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**NBR: 214895** **ACRONYM: MINOS** **EC FUND: 2267412**

**DG:** CNECT **Call: FP7-ICT-2007-C** **Thema:** ICT-2007.8.0

**Title:** Micro- and Nano-Optomechanical Systems for ICT and QIPC

**Abstract:** Micro- and Nanomechanical systems have the potential to revolutionize Information Science Technologies (IST) by bringing back mechanics as an essential component to information processing with completely new versatility. Already now, these systems are about to provide a broad range of novel applications with impact in a variety of fields such as life sciences, optical sciences, materials science and, eventually, quantum information science. European research has to play a central role in this exciting development. This STREP will provide future key technologies to achieve this goal. Downsizing mechanics to micro- and nanomechanical systems allows entering a novel regime in which the mechanical properties can directly be manipulated by light and vice versa. These optomechanical effects open up a completely new field of controllable light-matter interaction on the micro- and nanoscale. At present, Europe is among the key players in this young and emerging field of micro- and nano-optomechanical systems (MOMS/NOMS). The proposed STREP collects Europe’s leading scientists in the field to foster European competitiveness and to constitute clear lead competences. One main objective of the research initiative will be the development of new knowledge, methods and applications that can establish MOMS/NOMS as a future key technology for nanoscience. The prospects are clear: since both photonics and nanoscience will

certainly play a vital role in future ICT, a combination of these technologies has the potential to create synergies of unpredictable impact.

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**NBR: 214911** **ACRONYM: ICESTARS** **EC FUND: 2800000**

**DG:** CNECT **Call: FP7-ICT-2007-1** **Thema:** ICT-2007.3.1

**Title:** Integrated Circuit/EM Simulation and design Technologies for Advanced Radio Systems-on-chip

**Abstract:** A big challenge awaits for technological developments to keep up with the demands in the market due to both the large variety of wireless communication channels as well as the fact that they are essentially all used at the same time by widely varying applications. For planned developments of wireless communication channels in the SHF and EHF bands, IC design automation tools are indispensable. These tools are needed to develop nanoscale designs of unprecedented complexity and performance and, in addition, enable the achievement of single-pass design success to avoid costly re-spins and the loss of market opportunities. Currently it is impossible to provide accurate simulations of such a system, or even a smaller section of it encompassing just the RF front-end. The advent of multi-standard and software defined radios requires a new generation of transceiver architectures and corresponding CAD tools. Dealing with centre frequencies in the GHz range, the noise figure is a limitation for state-of-the-art designs. Many transceivers have to work in a mobile environment. Therefore low power consumption is mandatory which must be traded off with the circuit's linearity and gain. The key for enabling the realisation of single-chip integration of high-GHz wireless modules is resolving the shortcomings in available design flows. According to the 2006 Sematech roadmap this step in technology requires novel CAD tools and mathematical methods to deal with analogue/digital mixed signal simulation, with challenges in system design and methodologies, parasitic extraction, device and EM simulation, model extraction and optimisation tools. The ICESTARS project will deliver the methodologies and prototype tools to make this possible, by combining the research results of several domains to achieve a clear view on the dependencies between different parts of the complete RF design.

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**NBR: 214919** **ACRONYM: MULTIFLOW** **EC FUND: 6205912**

**DG:** REA **Call: FP7-PEOPLE-2007-1-1-ITN** **Thema:** PEOPLE-2007-1-1-ITN

**Title:** MULTI-SCALE COMPLEX FLUID FLOWS and INTERFACIAL PHENOMENA

**Abstract:** Understanding and controlling of interfacial phenomena in multiphase fluid dynamics remains one of the main challenges at the crossroad of Mathematics, Physics, Chemistry and Engineering. Examples include film flows, spreading and dewetting of (complex) liquids including suspensions, polymer solutions, liquid crystals, colloids and biofluids. Such systems are central for technological advances in the chemical, pharmaceutical, environmental and food industries and are crucial for the development of Microfluidics and Nanostructuring. The level of detail required by multi-scale flows with interfacial phenomena renders full-scale analyses practically impossible. In fact, such approaches often fail to describe even the results of simple experiments. MULTIFLOW will develop low-dimensional models capable of describing complex interfacial flows coupling different time and length scales. Based on the nature of the dominant mechanism, the scientific program will examine three generic classes: from nano- to macroscale, these are dominated by surface forces, reaction-diffusion, and advection. They are also affected by phase transitions, capillarity, chemical reactions, complex rheology and self-structuring. The strength of the network is its integration of all scientific disciplines, technical skills and expertise necessary to support the multi-scale nature of the envisaged research topics. By fostering the mobility and interdisciplinarity of a strong group of early-stage researchers through a set of well-defined objectives and effective networking between different institutions, disciplines and industries, the ultimate goals of this network are: (i) to create a multi-disciplinary, highly innovative and intersectorial training pool in the field of multi-scale interfacial fluid dynamics; (ii) to generate new tools and techniques for the theoretical-numerical-experimental investigation of such flows, which will be made available to the wider European Community.

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**NBR: 214936** **ACRONYM: ELCAT** **EC FUND: 3135208**

**DG:** REA **Call: FP7-PEOPLE-2007-1-1-ITN** **Thema:** PEOPLE-2007-1-1-ITN

**Title:** Surface Electrochemical Reactivity in Electrocatalysis: A combined Theoretical and Experimental Approach

**Abstract:** The aim of ELCAT is to train a new generation of young researchers in experimental and theoretical research methods in electrocatalysis. The scientific objectives are to address the problem of achieving specific reactivity in electrochemical transformations and to establish predictive tools based on quantum chemical calculations and computational modelling. The electrocatalytic properties of nanostructured metal and metal-oxide interfaces will be investigated using state of the art instrumental and experimental techniques. Four important electrochemical reactions have been chosen for their general importance in energy production, environmental control and clean chemicals production. Industrial participation in the Network will provide an understanding of the technological applications of electrocatalysis. The training objectives are to provide the young researchers with scientific skills as well as leadership qualifications to enable them to become established as independent researcherers in new areas thus providing

an attractive vision for their research careers For this to be achieved, ELCAT will provide training by interdisciplinary research involving several laboratories, exchanges between laboratories having complementary expertise and instrumentation, participation in workshops and conferences and training by courses arranged by the Network in both scientific issues and complementary skills. This project is timely due to the present confluence of theoretical and instrumental research techniques of unprecedented power, such as new computational methods, a new understanding of electron transfer reactions at the nanoscale and advanced in-situ spectroscopies and Scanning Probe Microscopies. There are new industrial requirements derived from important societal issues resulting in an urgent need for a new generation of trained young researchers with a modern background in experimental and theoretical techniques for applications in electrocatalysis.

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**NBR: 214945** **ACRONYM: MAGIC** **EC FUND: 11749999**

**DG:** CNECT **Call: FP7-ICT-2007-1** **Thema:** ICT-2007.3.1

**Title:** MAsk less lithoGraphy for IC manufacturing (MAGIC)

**Abstract:** In the CMOS manufacturing environment, the mask-based optical lithography technique is up to now the driving solution to deal with all industry concerns. Nevertheless, this solution becomes less effective for each new technology node. Effectively, it requires more and more complex and expensive masks due to the introduction of optical proximity correction and phase shift techniques. The blow up of the tool price plays also an important role in the overall cost of ownership of this technique. This trend opens opportunities for the Mask-Less Lithography (ML2) technology, based on multi-beam principles and developed by the two European companies MAPPER and IMS Nanofabrication AG. The cost effective model of the ML2 option in association with the high resolution capability of the electron lithography and a reasonable throughput target represents an attractive alternative for lithography and is supported by some key CMOS manufacturers around the world, like TSMC, STMicroelectronics, QIMONDA, TOSHIBA, and Texas Instruments… This project proposes to support the development of ML2 technology in Europe. It is composed of two linked poles. The first one will be focused on MAPPER and IMS-NANO tool developments with the objective to deliver a first ML2 alpha platform compatible for 32nm half pitch technology before 2010, aligned with the semiconductor manufacturer requirements. In relation with this activity, the program will develop the required infrastructure for the usage of these tools in an industrial environment. Among the tasks to be addressed, there is the delivery of a reliable software platform to treat the data base preparation and to provide solution for ML2 related electron beam proximity effects. The last concern of this project will be to demonstrate the ability to integrate CMOS processes in real manufacturing conditions on the ML2 platforms developed by the tool partners.

**NBR: 214954** **ACRONYM: HERODOT** **EC FUND: 3208812**

**DG:** REA **Call: FP7-PEOPLE-2007-1-1-ITN** **Thema:** PEOPLE-2007-1-1-ITN

**Title:** Heterogeneous quantum rod and quantum dot nanomaterials, towards a novel generation of photonic devices

**Abstract:** Recent progress in the fabrication of colloidal semiconductor nanocrystals has led to a wide range of quantum dots with a high oscillator strength, photoluminescence efficiency and size-tunable emission spectrum. The present proposal 'Heterogeneous quantum rod and quantum dot nanomaterials' aims at a comprehensive research and training program on the opto-electronic properties of heterostructured nanomaterials based on quantum rod and dot building blocks. More specifically, we will study quantum dot molecules, binary quantum dot solids, superstructures of aligned quantum rods and hybrid organic/inorganic systems with specific band alignment (type II heterostructures). The optical properties of these systems, e.g. polarizability, exciton lifetime and emission spectrum are determined by the delocalized, indirect nature of the exciton; while optical anisotropy can be achieved by alignment of quantum rods. Such systems can exhibit a large Stokes shift, enhanced nonlinear refraction, and an absorbance and emission spectrum that can be tailored by the architecture of the superstructure and external fields. This forms a direct route to applications of these materials in optimizing light sources and realizing fast and compact optical modulators and switches. The proposed training and research program is based on three research lines, synthesis and processing, characterization and modeling, and manipulation and application. With this program, we form researchers that can cope with the complex, multidisciplinary problems that the European opto-electronic industry will face in the implementation of nanotechnology and nanophotonics.

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**NBR: 215132** **ACRONYM: PRIMEBITS** **EC FUND: 2899999**

**DG:** CNECT **Call: FP7-ICT-2007-1** **Thema:** ICT-2007.3.2

**Title:** Printable memory solutions for sensor, ID, and media applications

**Abstract:** In the PriMeBits project, a printable electric low-voltage non-volatile memory is developed for printed sensor, media and wireless ID applications. The main strategy is to utilize printed technology where it has a competitive advantage compared to silicon technology. The project builds on basic research of new materials and components and takes the results into prototyping of new applications. To reduce the research risk, two different technologies for the memory functionality are considered with partially

overlapping application areas. Current printable polymer-based memory technologies typically suffer from i) the needed operating voltage being high, ii) too short lifetime in room atmosphere, iii) poor temperature stability, iv) chemically reactive materials needing encapsulation and/or v) time-consuming temperature-annealing steps in fabrication. Consequently, for many commercially attractive passive and battery-powered applications, the properties of current printable memories are unsuited. To overcome the shortcomings of prior-art approaches, printable inorganic metal-oxide-nanoparticle-based ferroelectric FRAM memory and a resistive metallic-based write-once-read-many (WORM) memory will be developed. To print the ferroelectric memory, new printing inks based on, for example, barium titanate (BaTiO3) nanoparticles will be developed. For the WORM memory, the project will aim at utilizing commercial metal-nanoparticle inks with possibly some customization. Depending on the application, a printed circuitry or an external device is used for the reading and writing of the memory.

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**NBR: 215193** **ACRONYM: NANO-HOST** **EC FUND: 3385388**

**DG:** REA **Call: FP7-PEOPLE-2007-1-1-ITN** **Thema:** PEOPLE-2007-1-1-ITN

**Title:** Homogeneous Supported Catalyst Technologies: the sustainable approach to highly-selective, fine chemicals production

**Abstract:** This proposal is aimed at generating new fundamental knowledge and fostering new prospects and frontiers, training and transfer of knowledge in the field of highly efficient, highly selective, supported, recyclable catalysts. Target of the research programme are strongly innovative methodologies for the preparation, recovery and reuse of single-site, multipurpose, nanostructured catalytic materials, and the engineering of reactors based on these catalysts, as this represents an essential part towards the elaboration of sustainable production processes of high-added value fine chemicals. The approach pursued will be the immobilization of homogeneous catalysts, and particularly transition metal complexes, onto preformed (in)soluble supports (heterogenised catalysts). Materials defined at the nanometric level obtained by surface organometallic chemistry will be also included. The focus will be thereupon on their applications on specific, selected reactions. In this project, we plan to use advanced catalyst design to develop catalysts in which the support allows improvements in terms of activity, selectivity, catalyst lifetime and versatility, compared to their homogeneous counterparts. This will be an interdisciplinary, jointly executed research project encompassing complementary, synthetic (inorganic supports, ligands, organometallic compounds, functionalized polymers, dendrimers, nanoparticles), reactivity (homo- and heterogeneous catalyst screening and recycle, product analysis), characterization (advanced techniques for materials and in situ investigations), engineering (continuous-flow / supercritical flow reactors) and modelling activities.

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**NBR: 215297** **ACRONYM: S-PULSE** **EC FUND: 550000**

**DG:** CNECT **Call: FP7-ICT-2007-1** **Thema:** ICT-2007.3.1

**Title:** Shrink-Path of Ultra-Low Power Superconducting Electronics

**Abstract:** The proposed Support Action S-PULSE aims to prepare Superconducting Electronics (SE) for the technology generation beyond the CMOS scaling limits ("beyond CMOS"). Scaling laws in CMOS technology indicate that some concepts cannot be simply extrapolated, and new physical effects that have been negligible up to now, have to be taken into account in the future. Due to the total different physical base in SE, it never had a scaling law, and quantum limits define the ultimate speed. This provides already demonstrated logic operation speed above 100 GHz with typically power dissipation of 1 aJ per logic operation with a 1 µm feature size metal based process. The European activities in SE are currently coordinated by the non-profit Society FLUXONICS e.V., a SCENET initiative under FP6 for a dynamic technology platform in SE. As a major outcome of this network, a circuit foundry for SE was established, a cell library was made available and a first roadmap was drawn up in the field. S-PULSE supports joint efforts of European academic and industrial groups in the superconducting technologies field. The action is to strengthen the vital link between research and development on the one hand and the industrial view on the other hand, bring together industrial expectations and visionary extrapolation and current status of technology, intensify the exchange of knowledge and ideas, take charge of education, and win public interest. The overall strategy of S-PULSE is to broaden the FLUXONICS network and to promote the formation of a European Technology Platform (ETP) to develop and implement a Strategic Research Agenda in the field of ultra-low power superconducting electronics down to the nano-scale domain. With the view on the formation of an industrial guided ETP in the field of SE, the SA is expected to strengthen the competitiveness of the European nanoelectronics industry and to make SE technologies ready to compete with other technologies in the world markets.

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**NBR: 215360** **ACRONYM: DELTA-MIN** **EC FUND: 3109822**

**DG:** REA **Call: FP7-PEOPLE-2007-1-1-ITN** **Thema:** PEOPLE-2007-1-1-ITN

**Title:** Mechanisms of Mineral Replacement Reactions

**Abstract:** In this ITN we investigate the mechanism of mineral reequilibration (phase transformation) in the presence of a fluid phase in a wide range of minerals and rocks, under a range of chemical and physical conditions, using both natural and experimental samples. Interface-coupled dissolution-reprecipitation is a recently defined mechanism which applies to a wide range of mineral transformation phenomena. We apply these

principles in individual projects to better understand the mechanisms of processes important in earth sciences and in industry, including metasomatic reactions in rocks, chemical weathering, mineral replacement mechanisms in CO2 sequestration, the aqueous durability of nuclear waste materials, remediation of contaminated water by mineral reaction, and the preservation of stone-based cultural heritage. The research methods bring together a range of complementary expertise, from field-related studies to nano-scale investigations of reaction interfaces using state-of-the-art high resolution analytical methods. The application of fundamental principles of mineral reequilibration to a wide range of applications, together with industrial involvement at all levels will ensure that the project provides a strong platform for training.

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**NBR: 215368** **ACRONYM: SEMISPINNET** **EC FUND: 3209394**

**DG:** REA **Call: FP7-PEOPLE-2007-1-1-ITN** **Thema:** PEOPLE-2007-1-1-ITN

**Title:** Initial Training Network in Nanoscale Semiconductor Spintronics

**Abstract:** We propose an Initial Training Network for advanced nanoscale semiconductor spintronics. This is a coordinated programme of technological, experimental and theoretical research, training and knowledge transfer, by a consortium of leading European academic and industrial research groups. Spintronics is becoming increasingly important as downscaling and power usage in microelectronics approaches fundamental limits. This ITN will provide a framework for structuring research and training efforts in this field and exploiting the new technology. The programme will move well beyond the worldwide state-of-the-art, through development of novel multifunctional nanospintronic devices, by transfer of device concepts to room temperature operation, and by exploration of the potential of low-dimensional systems. This coordinated wide-ranging and multidisciplinary programme is only achievable through a cross-European approach. The ITN will supply the required multidisciplinary and intersectorial training in materials development, device physics and technology and theory, which is crucial for ensuring a highly developed research infrastructure and a critical mass of qualified researchers in this key research area. Researcher mobility will be encouraged, with all appointed fellows spending periods at academic and industrial hosts. Industrial partners will be central to the training programme, ensuring that fellows have an understanding of the needs of end-users of the research. Transferable skills training will be supplied to meet wider employment market needs. The proposal is highly relevant to the ITN objectives, the Information Society Technologies and Nanotechnologies thematic areas of FP7, and ERA strategies to network centres of excellence, increase researcher mobility, and improve cohesion in research. The ITN will provide a body of highly skilled scientists, equipped with the expertise to ensure that European research continues to flourish in this vital area.

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**NBR: 215399** **ACRONYM: FINELUMEN** **EC FUND: 3616956**

**DG:** REA **Call: FP7-PEOPLE-2007-1-1-ITN** **Thema:** PEOPLE-2007-1-1-ITN

**Title:** Cavity-confined Luminophores for Advanced Photonic Materials: A Training Action for Young Researchers

**Abstract:** "FINELUMEN" is a 4-year project aiming at the preparation and extensive characterization of luminescent materials in which suitably designed organic and inorganic luminophores are encapsulated within nano-containers (carbon nanotubes and coordination cages) in which they can preserve and even improve their emission output. The ultimate goal is to create a library of luminescent modules emitting throughout the VIS-NIR region for producing superior functional hybrid materials. The emission colour tunability is defined by the emitting guest, while the versatility in the final application is controlled via tailored chemical functionalisation of the host. The versatile properties of these materials will make them attractive in at least 3 applicative areas, i.e. bioimaging, optoelectronic devices and sensors. The participation of a giant company and a high-tech SME in the consortium ensures a quick patenting and industrial scale up of the most promising luminescent materials, strengthening Europe's competitiveness in a field of huge growth potential in the next decade. The research endeavour inside "FINELUMEN" calls for a multidisciplinary team in which key groups, experts in many different fields of chemistry, physics and engineering tightly interact. For this reason training and exchange of young researchers represents the core of the"FINELUMEN" activity To both early-stage and experienced researchers, a multidisciplinary training in the realm of synthetic/supramolecular/physical chemistry, photosciences, and engineering as well as management, communication, and IPR is offered, preparing them for positions in academia, industry, and government labs. The local and network-wide training and transfer of knowledge activities are strengthened by 2 authoritative visiting scientists, enriched by 3 FINELUMEN international summer schools and conferences, and complemented via PhD programmes in co-tutoring among partners based in different countries.

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**NBR: 215507** **ACRONYM: BIOMINTEC** **EC FUND: 2300000**

**DG:** REA **Call: FP7-PEOPLE-2007-1-1-ITN** **Thema:** PEOPLE-2007-1-1-ITN

**Title:** Biomineralization: Understanding of basic mechanisms for the design of novel strategies in nanobiotechnology

**Abstract:** Biomineralization is the formation of minerals by living cells and organisms. To understand the processes involved in biomineralization, at the cutting edge between inorganic and organic world, the cooperation between molecular and cell biologists,

inorganic chemists, and physical chemists, but also computational scientists is required. The products formed by biomineralization are often composite materials consisting of both mineral and organic components. The ability of organisms to form nanostructured biominerals with high precision and in large copy number under biological and environmentally benign conditions makes the mechanisms underlying biomineral formation extremely interesting for nano(bio)technology, a key technology of the 21st century. In the proposed Marie Curie Initial Training Network, we focus on the formation of biominerals consisting of calcium carbonate or biosilica-glass due to the enormous interest and importance that these biominerals have achieved in the last few years. The successful research on this topic which also includes the future industrial application of the results relies on the coordinated multidisciplinary effort of highly qualified researchers with special skills in different disciplines. There is, in particular, an urgent need for training of young researchers in Europe in this pioneering area of research. The goal of this multidisciplinary network is to understand basic principles of biomineralization (bio-silicification and bio-calcification) in order to develop novel strategies to apply the biological mechanisms in the field of nanotechnology. To achieve this goal, an effective and milestone-oriented joint training and transfer-of-knowledge programme will be established. It is expected that - through training of young researchers in the most advanced techniques to study biomineralization – this network will strengthen the competitiveness of the European Union in this important field of present-day research.

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**NBR: 215723** **ACRONYM: SPAM** **EC FUND: 4300696**

**DG:** REA **Call: FP7-PEOPLE-2007-1-1-ITN** **Thema:** PEOPLE-2007-1-1-ITN

**Title:** Surface Physics for Advanced Manufacturing

**Abstract:** Today, markets demand smaller, cheaper, energy friendly and more different consumer products. Last decades micro technology has opened possibilities for mobile communication, safety and health science products. To meet these demands, the industry is encountering technological barriers that prevent the industry from evolving from the micro to a nanotechnology era. To resolve these barriers, the industry and research institutes need to initiate research programmes, and need to structure and integrate its research programmes and transfer the knowledge that as been acquired in these programmes. “New” researchers have to be trained with excellent research skills, knowledge on the specific technology, and understanding of market demands, application development, and so on. For this purpose 4 industrial, 5 academic and 3 research institutes have defined the 4 year SPAM research and training program; “a Supra-disciplinary approach to research and training in surface Physics for Advanced Manufacturing - SPAM”. Research objectives are: • identify and develop crucial knowledge in the field of surface physics, • enable the manufacturing of smaller semi-conductors and hence technology to print under 32 nm; extreme positional accuracy (<

4 nm); at competitive cost, • use this knowledge to further develop lithography technologies/tools needed for cost efficient development of nano-electronic devices, including manufacturing processes. Training objectives are: • provide personalised individual training, in particular for 16 ESR but also for 6 ER, to prepare and optimise their research in SRTs, with the help of 9 VS. • provide a network-wide training, fully exploiting the network potential and complementarities, leading to 12 network events. • transfer existing knowledge between partners through the SRTs and to transfer newly gained knowledge. Meeting the objectives are the responsibility of 4 Supra-disciplinary Research Teams (SRT) and 5 interlinking Training Exchange Pools.

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**NBR: 215750** **ACRONYM: MOLOC** **EC FUND: 2040000**

**DG:** CNECT **Call: FP7-ICT-2007-1** **Thema:** ICT-2007.8.1

**Title:** Molecular Logic Circuits

**Abstract:** MOLOC – Molecular Logic Circuits seeks to design and provide demonstration of principle, feasibility and significant advantages of logic circuits where the basic element is a single molecule (or assemblies of atoms or molecules) acting in itself as a logic circuit. The functionalities provided by this new post-Boolean approach differ in essential ways from using a molecule as a switch. The approach depends on molecules (or nanostructures, etc) having internal degrees of freedom and multiple (quasi)stationary states by virtue of their confined size. We therefore make an advantage of the nanosize which is imposed by the cardinal technological need to reduce the size of the circuit in order to implement complex logic functions at the hardware level and thereby add new functionalities. Exploratory work has shown that it is possible to address the states of a single molecule either electrically (or electrochemically) or optically and also that it is possible to concatenate the logic operation of two molecules. The partners to MOLOC are cognizant that to go beyond the projected limits of CMOS technology will likely be most productive if it be a surface based approach. All the same, foundational work in the gas or liquid phase is also discussed. MOLOC proposes parallel computing rather than the more familiar sequential model, it proposes to take advantage of inherent internal degrees of freedom of molecules and their dynamics in order to implement finite state machines, machines that can store information to be used later in the computation and to consider circuits where the logic goes beyond Boolean , meaning that variables are not restricted to be either true (=1) or false (=0). Towards its objectives MOLOC proposes to gather a team of European experts in the different and complementary areas of foundational research. The experimental teams can be characterized by the methods used to address (or probe) the molecule. There is also one theoretical work package.

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**NBR: 215752** **ACRONYM: GRAND** **EC FUND: 2389704**

**DG:** CNECT **Call: FP7-ICT-2007-1** **Thema:** ICT-2007.8.1

**Title:** Graphene-based Nanoelectronic Devices

**Abstract:** The semiconductor industry is a cornerstone of today's high-tech economy, supporting over 100,000 direct and even more indirect jobs in Europe. This position has been achieved through continued miniaturization in complementary metal-oxide-semiconductor (CMOS) technology, which will only last for a maximum 10-15 more years. In line with its Lisbon Strategy, the EC has identified an urgent need to assess possible technology solutions for the "Beyond CMOS" era to meet the challenges of global competition. The major ICT challenge is to find alternatives for information processing and storage beyond the limits of existing CMOS. Graphene, ultrathin layers of carbon, is particularly promising due its novel electronic properties. Initial data indicates that graphene is a prime candidate for "Beyond CMOS" switches and interconnects, and is, despite its revolutionary nature, complementary to conventional CMOS. The key objective of the GRAND proposal is to verify and assess whether graphene can bring conventional semiconductor technology to the "Beyond CMOS" era. GRAND is thus positioned to act as a pathfinder for key ICT challenges. The GRAND consortium will develop industry-compatible strategies for fabrication of 2D graphene nanostructures (widths down to the 5 nm scale) for switches and interconnects. Edge states, critical for transport at this scale, will be manipulated by functionalization methods. Device transport properties will be experimentally evaluated, complemented by a range of modelling techniques including simplified Monte Carlo models to describe scattering and hot phonon effects, as well as atomistic and ab-initio methods for band structure calculations. The consortium includes internationally renowned experimental and theoretical groups from academia and industry, forming a comprehensive unit with capabilities far beyond those of the individual partners, and ensuring a tight focus on the exploitation of the project results for European industry.

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**NBR: 215851** **ACRONYM: HIERARCHY** **EC FUND: 4648957**

**DG:** REA **Call: FP7-PEOPLE-2007-1-1-ITN** **Thema:** PEOPLE-2007-1-1-ITN

**Title:** Hierarchical Assembly in Controllable Matrices

**Abstract:** The mission of HIERARCHY is to train and educate young scientist in the rapidly developing field of nanosciences, in particular hierarchical self-assembly. The training programme educates early stage and experienced researches in many aspects of this highly interdisciplinary field, such as theory, materials chemistry and biochemistry, advanced characterisation techniques, physics and commercial device development. In

addition, the training programme will address non-scientific issues, important for the career development of young scientists, e.g. communication and presentation skills, IPR and entrepreneurial skills, ethical issues, language enhancement and cultural awareness. The training takes place on a Network level and also locally at the host institutions. HIERARCHY's training programme will deliver versatile individuals with a broad scientific knowledge, ready to pursue a successful career in the European industry or academia. The interdisciplinary research training is centralised around the novel concept of hierarchical assembly in controllable matrices. This concept exploits liquid crystalline media as controllable matrices for programmed self-organisation, which goes far beyond the possibilities of currently employed techniques. A liquid crystal matrix in combination with a variety of simultaneously or sequentially applied external stimuli will yield a unique toolbox to build functional macroscopic structures with nanometer control. Leading European laboratories in soft condensed matter and solid state matter will work towards new paradigms in nanosciences. HIERARCHY's intention towards application of the designed structures, illustrated by the presence of three industrial partners in the consortium, is an important step towards commercialisation of nanosciences in Europe. With Europe's desire to become the major player in the area of nanosciences, valorisation of developed technology is a key lesson for Europe's new generation of nanoscientists.

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**NBR: 216011** **ACRONYM: MINILUBES** **EC FUND: 2719525**

**DG:** REA **Call: FP7-PEOPLE-2007-1-1-ITN** **Thema:** PEOPLE-2007-1-1-ITN

**Title:** Mechanisms of interactions in nano-scale of novel ionic lubricants with functional surfaces

**Abstract:** Recently, ionic liquids (IL) are employed as substitute for traditional solvents in catalysis, synthesis and electrochemistry. But little research work or actual applications have been published until now concerning the utilization of IL as lubricants. Generally, IL show no or very low vapour pressures, satisfying viscosity-temperature behaviour, no inflammability and high thermal stabilities up to 250°C. The choice of cation and anion as well as the design of side chains determine fundamental IL properties. These properties desirable for lubricants and the possibility to create tailor-made compounds give rise to the demand of in-depth investigations of IL in tribology. To our best knowledge, the project will be the first extensive and integral approach of IL towards potential future applications as lubricants for metals, ceramics and polymers as well as base for wear and friction reducing nanoparticles. The investigations will involve molecular design and synthesis of new IL as well as preparation of advanced materials containing or based on IL. Evaluation of lubricant and material performance will range from determination of physico-chemical properties including artificial aging of IL and mechanical testing (e.g. tensile and impact strength) to tribometrical experiments. Wear and friction properties will be completed by thorough surface characterization, in

particular towards tribochemical reaction layers. Parameters gained from these experiments will be used for modelling of triboprocesses in nanoscale and for molecular design of new ionic lubricants. Studies on biodegradability, toxicology and economical aspects will be studied in detail, too, to verify legal requirements and opportunities for highly potential applications. The overall objective of this interdisciplinary and intersectorial approach is the generation of unique and comprehensive knowledge about IL on a sustainable basis for future implementations as high performance lubricants.

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**NBR: 216031** **ACRONYM: CD-MEDICS** **EC FUND: 9500000**

**DG:** CNECT **Call: FP7-ICT-2007-1** **Thema:** ICT-2007.5.1

**Title:** Coeliac Disease â€“ Management, Monitoring and Diagnosis using Biosensors and an Integrated Chip System

**Abstract:** The overall concept of the CD-MEDICS IP is to develop a technology platform for point-of-care diagnostics, capable of simultaneous genomic and proteomic detection, with embedded communication abilities for direct interfacing with hospital information systems. This will be achieved by exploiting breakthroughs at the confluences of bio-, micro- and nano- technologies to create a low-cost non-invasive intelligent diagnosis system. This platform will be developed in a modular format, which will allow each module to be developed and exploited individually. The modules will subsequently be integrated to facilitate the desired application. Advances in data communications, molecular biology and biosensor technology, with the integration of nanostructured functional components in macro and microsystems, will facilitate the realisation of a minimally invasive generic platform, which is capable of multi-parametric monitoring and will be interoperable with electronic medical records. The advantages of integrated biosensor systems include their ease of use, their sensitivity, their inherent selectivity (preventing problems due to interfering substances), their versatility (allowing 'in-field' use) and their cost effectiveness. Addressing the future health care requirement of an individualised theranostic approach, the specific application that will be demonstrated in this IP will be for the management, monitoring and diagnosis of coeliac disease, with the proposed technology contributing to significant advances in sensitivity and specificity of diagnosis. The technology platform developed, however, could be applied to a variety of clinical screening applications, such as cancer. The radical innovation proposed in this IP will result in a concrete prime deliverable of a technology platform of wide application and unquestionable socio-economic benefit, increasing European competitiveness whilst contributing considerably to the quality of life well-being of the population.

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**NBR: 216110** **ACRONYM: DOTFIVE** **EC FUND: 9699969**

**DG:** CNECT **Call: FP7-ICT-2007-1** **Thema:** ICT-2007.3.1

**Title:** Towards 0.5 Terahertz Silicon/Germanium Heterojunction Bipolar Technology

**Abstract:** DOTFIVE is a three-year IP proposal for a very ambitious project focused on advanced RTD activities necessary to move the Silicon/germanium heterojunction bipolar transistor (HBT) into the operating frequency range of 0.5 terahertz (THz) (500 gigahertz GHz) enabling the future development of communication, imaging or radar Integrated Circuits (IC) working at frequencies up to 160 GHz . For a given lithography node bipolar transistors and more recently HBT have always lead the frequency race compared to MOS devices, while offering higher power density and better analogue performances (transconductance, noise, transistor matching).The main objective of this highly qualified consortium is to establish a leadership position for the European semiconductor industry in the area of millimeter wave (mmW) by research and development work on silicon based transistor devices and circuit design capabilities and know-how. SiGe HBT is a key reliable device for applications requiring power >few mW (future MOS limitation) and enabling high density, low cost integration compared to III-V. To achieve the goal DOTFIVE unites a powerful consortium: Seven academic partners for the physics understanding of nanotransistors, simulation, modeling, and characterization (down to few k) of devices; as well as the design and characterization of demonstrator electronic blocks (Low Noise Amplifier, mixers…). Two research institutes in charge of developing novel process modules and transistor structures on silicon wafers, capable of fabricating innovative SiGe HBT concepts. Two industrial companies, capable of producing 250 GHz HBT on silicon, and willing to push their capabilities to 500 GHz by incremental structural and technological improvements utilizing some of the most advanced equipments introduced recently by the CMOS miniaturization race. Two SME capable to deliver to designers, transistor parameter extraction and RF advanced compact models for all the silicon providers above.

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**NBR: 216165** **ACRONYM: NANOICT** **EC FUND: 950000**

**DG:** CNECT **Call: FP7-ICT-2007-1** **Thema:** ICT-2007.8.1

**Title:** Nano-scale ICT Devices and Systems Coordination Action

**Abstract:** In the semiconductor industry, CMOS technology will certainly continue to have a predominant market position in the future. However, there are still a number of technological challenges, which have to be tackled if CMOS downscaling should be pursued until feature sizes will reach 10 nm around the year 2015-2020. The NanoICT Coordination Action activities will reinforce and support the whole European Research

Community in “ICT nanoscale devices” covering the following research areas expected to demonstrate unconventional solutions beyond the expected limits of CMOS technology. • Demonstration of new concepts for switches or memory cells • Demonstration of new concepts, technologies and architectures for local and chip level interconnects with substantial improvements over current solutions • Demonstration of radically new functionalities by the integration of blocks from a few nanometres down to the atomic scale into high added-value systems The CA action plans will go beyond the organisation of conferences, workshops, exchange of personnel, WEB site, etc. developing the following activities: • Consolidation and visibility of the research community in ICT nanoscale devices • Mapping and benchmarking of research at European level, and its comparison with other continents • Identification of drivers and measures to assess research in ICT nanoscale devices, and to assess the potential of results to be taken up in industrial research • Coordination of research agendas and development of research roadmaps • Coordination of national or regional research programmes or activities, with the aim to involve funding authorities in building the ERA around this topic • Development of strategies for international cooperation on themes related to NanoICT Expected impact will be the enhanced visibility, shaping and consolidation of the NanoICT research community in Europe.

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**NBR: 216171** **ACRONYM: NANOSIL** **EC FUND: 4300000**

**DG:** CNECT **Call: FP7-ICT-2007-1** **Thema:** ICT-2007.3.1

**Title:** Silicon-based nanostructures and nanodevices for long term nanoelectronics applications

**Abstract:** NANOSIL Network of Excellence aims to integrate at the European level the excellent European research laboratories and capabilities in order to strengthen scientific and technological excellence in the field of nanoelectronic materials and devices for terascale integrated circuits (ICs) and disseminate the results in a wide scientific and industrial community. NANOSIL will explore and assess the science and technological aspects of nanodevices and operational regimes relevant to n+4 technology node and beyond. It will provide a forward-look for the industry, enabling informed decisions to be taken on technology development in order to speed up technological innovation. It will encompass flagship projects on nanoscale CMOS and post-CMOS. The activities will thus be centred on the “More Moore” and “Beyond-CMOS” domains but natural links will also been established with the other ENIAC areas. Within the Network there are all the critical facilities and expertise to occupy and transcend this space. We will propose innovative concepts, technologies and device architectures- with fabrication down to the finest features, and utilising a wide spectrum of advanced deposition and processing capabilities, extensive characterisation and world leading device modelling. This work will be carried out through a network of joint processing, characterisation and modelling platforms. The consortium will work closely with and take steering from European

industry. It will feed back data and know-how on materials and devices that deliver the required performance. This critical interaction will strengthen European integration in nanoelectronics, help in decision-making by industry and ensure that Europe remains at the forefront of nanoelectronics for the next 2 – 3 decades.

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**NBR: 216176** **ACRONYM: NANOPACK** **EC FUND: 7399980**

**DG:** CNECT **Call: FP7-ICT-2007-1** **Thema:** ICT-2007.3.1

**Title:** Nano Packaging Technology for Interconnect and Heat Dissipation

**Abstract:** One of the major limitations to continued performance increases in the semiconductor and power electronics industries is integration density and thermal management. Continued transistor downscaling is quickly reaching its limits forcing a new focus on heterogeneous integration and 3D packaging technologies to continue performance improvements by reducing interconnect length between memory and multi-core logic. These efforts must combine high density electrical interconnects with low resistance thermal interfaces to remove heat from the intricate layered assemblies. Power electronics applications in hybrid vehicles and power supplies are also being pushed to new integration densities that are largely limited by the ability to transfer heat across interfaces to liquid coolers and heat sinks. Improved thermal management and integration densities for these applications will also be important to improve energy and manufacturing efficiency and component reliability. The proposed project aims at developing new technologies and materials for low thermal resistance interfaces and electrical interconnects by exploring systems such as carbon nanotubes, nanoparticles and nano-structured surfaces using different enhancing contact formation mechanisms combined with high volume compatible manufacturing technologies such as electro-spinning. Recent groundbreaking work on nested channel interfaces to control particle interactions during the formation of interfaces will be utilized to exploit the beneficial properties of the new materials. In addition, state-of-the-art modelling and simulation techniques with world class supercomputers will be combined with the development of experimental test structures to measure the performance of new interface technologies and validate design tools. Finally the technology will be used in several different applications to demonstrate improved performance of high power radio frequency switches, microprocessors and hybrid vehicle power electronics.

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**NBR: 216215** **ACRONYM: CATHERINE** **EC FUND: 2649999**

**DG:** CNECT **Call: FP7-ICT-2007-1** **Thema:** ICT-2007.8.1

**Title:** Carbon nAnotube Technology for High-speed nExt-geneRation nano-InterconNEcts

**Abstract:** CATHERINE will provide a new unconventional concept for local and chip-level interconnects that will bridge ICT beyond the limits of CMOS technology. The main goals of CATHERINE are: G1) to develop an innovative cost-effective and reliable technological solution for high-performance next-generation nanointerconnects. G2) to develop proof-of-concept nanointerconnects to assess and verify the new proposed solution The expected results of CATHERINE are then summarized by the following points: R1) definition of all causal relations within the design-chain "microstructure characteristics – fabrication process – functional properties" R2) development of multiscale multiphysics simulation models for the prediction of the multifunctional performance of the interconnect and for the EMC analysis R3) development of electromagnetic and multifunctional test procedures and experimental characterization methods R4) manufacturing and testing of proof-of-concept samples of nanointerconnects at laboratory level. The final project product will be: P1) integrated data-base for nanointerconnect design P2) proof-of-concept nanointerconnect The new bottom-up approach proposed by CATHERINE consists in realizing CNT-based nano-interconnects for integrated circuit exploiting two different techniques: (i) a template-based CVD technique that allow high control of the growth of perfect aligned arrays of CNTs. The CNTs are synthesized within the pores of properly designed alumina nanostructures. CNTs wall thickness is controlled by the reaction time, the CNT length by the thickness of alumina nanostructures, the CNT external tube diameter by the nanostructures pore size; (ii) CVD growth of CNTs and carbon nanofibers (CNFs) on substrate patterned with nano-imprint lithography. Both techniques do not require electron beam lithography (EBL) for CNTs growth or substrate preparation. The resulting process is cost-effective and can be easily implemented at industrial scale.

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**NBR: 216405** **ACRONYM: WADIMOS** **EC FUND: 2299982**

**DG:** CNECT **Call: FP7-ICT-2007-1** **Thema:** ICT-2007.3.1

**Title:** Wavelength Division Multiplexed Photonic Layer on CMOS

**Abstract:** WADIMOS proposes to develop a generic technology for the realization of complex electro-photonic integrated ICs using standard CMOS processing technologies. These ICs will contain a photonic interconnect layer incorporating microsource arrays and ultracompact WDM (wavelength division multiplexing) functionality based on silicon nanophotonic wire circuits, driven directly from by the CMOS electronic circuitry. The photonic interconnect layer is intended to be incorporated in between the uppermost copper layers of an electronic IC. The availability of such ICs will benefit many applications in telecom, local access, datacom, automotives, avionics and sensing, on- and off-chip interconnect. Two applications will be investigated in particular: a 100TB/s datalink for a maskless-lithography tool based on a massively parallel e-beam tool and

an optical network-on-chip based on a wavelength routed network directly integrated with CMOS circuits. The latter is addressing the expected limitations imposed by future purely electrical interconnects in complex MPSoC systems. These two applications are each backed by an industrial partner and their architectural design will be studied in separate workpackages, resulting in a set of specifications for the subcomponents forming the electro-photonic IC. Based on these inputs the different subcomponents will be designed, fabricated and characterized. The most relevant subcomponent is a III-V silicon heterogeneous multi-wavelength microsource array, which will be realized fully in a CMOS-pilot line, based on a process previously developed by project partners and independently by INTEL/USCB researchers. Finally, the different subcomponents will be integrated into two demonstrators each addressing one of both applications under study.

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**NBR: 216436** **ACRONYM: ATHENIS** **EC FUND: 5150000**

**DG:** CNECT **Call: FP7-ICT-2007-1** **Thema:** ICT-2007.3.1

**Title:** Automotive Tested High-voltage Embedded Non-volatile memory Integrated SoC

**Abstract:** More than 20% of the value of each car already comes from embedded electronics. Keeping costs and space for additional functionality low requires further integration of electronic components such as low and high voltage devices and memory on a single System-on-Chip (SoC). SoC technologies for segments with lower reliability requirements are already available. However, there are no cost-effective technologies yet combining all of the harshest automotive reliability requirements for full SoC integration of powertrain ICs for engines, starters, alternators, etc. This barrier to powertrain IC SoC integration inhibits cost reduction and introduction of more fuel efficient cars. The purpose of ATHENIS is to provide proof of concept for the industry's first SoC technology platform that can surmount these integration barriers. The ATHENIS SoC technology platform is intended to be the first in meeting the combination of all of the harshest requirements including full reverse polarity capability at the low cost of CMOS, application voltages up to 120V, currents up to 10A, temperatures up to 200°C, embedded non-volatile memory, chip-level ESD up to =8kV HBM, and high logic gate densities. This will be achieved by combining HVCMOS technology from austriamicrosystems AG with MEMS-based "Nanomech" embedded Non-Volatile Memory (eNVM) technology from Cavendish Kinetics. Innovative (patent pending) add-on technology modules such as reverse polarity HVCMOS and =8kV ESD structures for HVCMOS as well as automotive extensions for Nanomech will be developed. An alternator-like demonstrator with and without eNVM is selected for a worst case proof of concept. eNVM will enable "flexibility" to software-configure alternator systems for multiple car platforms. Valeo Electrical Systems will provide system specifications, system development and system evaluation. The other research partners contribute the required novel characterization, reliability, test, and simulation methodology.

**NBR: 216537** **ACRONYM: REALITY** **EC FUND: 2899883**

**DG:** CNECT **Call: FP7-ICT-2007-1** **Thema:** ICT-2007.3.1

**Title:** Reliable and Variability tolerant System-on-a-chip Design in More-Moore Technologies

**Abstract:** As miniaturization of the CMOS technology advances designers will have to deal with increased variability and changing performance of devices. Intrinsic variability of devices which begins to be visible in 65nm devices already will become much more significant in smaller technologies. Soon it will not be possible to design systems using current methods and techniques. Scaling beyond the 32 nm technology node brings a number of problems whose impact on design has not been evaluated yet. Random intra-die process variability, reliability degradation mechanisms and their combined impact on the system level parametric quality metrics are becoming prominent issues. Dealing with these new challenges will require an adaptation of the current design process: a combination of design time and runtime techniques and methods will be needed to guarantee the correct functioning of Systems on Chip (SoC) over the product's lifetime, despite the fabrication in unreliable nano-scale technologies. The objective of this project is to develop design techniques and methods for real-time guaranteed, energy-efficient, robust and self-adaptive SoCs. The technological challenges to be tackled are: (a) Increased static variability and static fault rates of devices and interconnects; (b) Increased time-dependent dynamic variability and dynamic fault rates. (c) Build reliable systems out of unreliable technology while maintaining design productivity; (d) Deploy design techniques that allow technology scalable energy efficient SoC systems while guaranteeing real-time performance constraints. In order to tackle these challenges we focus our effort along two main axes: (a) Analysis of the system in terms of performance, power and reliability of manufactured instances across a wide spectrum of operating conditions. (b) Solution techniques to mitigate impact of reliability issues of integrated circuits, at component, circuit, and architecture and system design.

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**NBR: 216668** **ACRONYM: VIACARBON** **EC FUND: 2530000**

**DG:** CNECT **Call: FP7-ICT-2007-1** **Thema:** ICT-2007.8.1

**Title:** Carbon Nanotubes for Interconnects and Switches

**Abstract:** VIACARBON aims to develop carbon nanotubes for vertical and horizontal interconnects for CMOS nodes of 22 nm and beyond, and for NEMS RF switches. Carbon nanotubes are universally proposed as interconnects because of their huge current carrying capacity of 1E9 A/cm2. However, interconnects also need a low resistance, at least as low as

copper. As CNTs are 1-dimensional conductors, they have a minimum quantum resistance of 6 kohms, which can only be reduced by laying many CNTs in parallel. The project aims to grow single wall nanotube mats with density of over 1E13 cm-2, by optimisation of the growth catalyst, and convert this into an industrially compatible technology for both vertical and horizontal interconnects. A second aspect is to fabricate arrays of NEMs as RF switches to support new device functions in the interconnect layer: for reconfigurable interconnects, banks of programmable passives and power current switch.

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**NBR: 216777** **ACRONYM: NABAB** **EC FUND: 2140000**

**DG:** CNECT **Call: FP7-ICT-2007-1** **Thema:** ICT-2007.8.1

**Title:** NAnocomputing Building blocks with Acquired Behaviour

**Abstract:** Targeting the development of computing solutions complementing logic functions based on CMOS, the main objective of the NABAB project consists of "demonstrating that it is possible to obtain useful computing functions as the result of a post-fabrication learning/adaptation process taking advantage of the rich functionality provided by interconnected nano devices". The NABAB project will explore the feasibility of a functional nano computing block (NAB) that will be built by interconnecting molecular electronics devices based on new nanoscale organic field-effect transistors (FET), functionalised nanotubes FET or ZnO FET that provide a rich combination of functions (memory and gain, sensitivity to various local or global stimuli). The project will show, as a primarily target, that such a NAB can acquire a specific, non-trivial, computing function by means of an internal adaptation process (learning, reconfiguration, self-organization). Besides, an important aspect of the project is to show that the acquired functionality of the NAB is exploitable within a realistic and larger computing system. To this extent an appropriate scheme for electrical and logical interfaces will be devised so as to make the function available at higher levels and relevant to realistic application concerns. Indeed competing advantages are sought on the one hand for reasons such as enabling the use of high parameter variability technologies, on the other hand for reasons such as providing novel functionalities (i.e. associative memory, classifiers) complementing classical logic functions. In order to achieve the ambitious objectives of the NABAB project, the consortium involves 5 complementary research organisations with the necessary excellence in domains like nano and molecular electronics devices, computing architecture, neural networks and analogue design.

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**NBR: 217778** **ACRONYM: NANOPLAT** **EC FUND: 599855**

**DG:** RTD **Call: FP7-SCIENCE-IN-SOCIETY-2007-1** **Thema:** SiS-2007-1.2.3.2-CT

**Title:** Development of a Platform for Deliberative Processes on Nanotechnology in the European Consumer Market

**Abstract:** The main idea behind this Support action is to develop a platform for deliberative processes on Nano-science and Nano-technology (NS&T) in the European consumer market. Nanotechnology products are now reaching the consumer markets within a large number of branches. During the last year, the number of consumer products using nanotechnology has more than doubled, from 212 to 475. Clothing and cosmetics top the inventory at 77 and 75 products, respectively. We will concentrate on deliberative processes concerning human and environmental safety, ethical and moral dilemmas, and perceptions of risks and responsibilities as revealed through a focus on the market interfaces across the value chain of consumer goods. Consumers, citizens and their organisations could be the most important stakeholders in the diffusion process of nano-products in Europe and beyond. The main goal is to evaluate and stimulate the deliberate dialogue, and give scientific support to the stakeholders responsible for this dialogue. We will • Evaluate selected deliberative processes in Europe, both at the EU and national level. These evaluations will have a general NS&T perspective, with special focus on consumption • Identify the needs and interest of relevant stakeholders along this value chain, especially focusing on producers, consumers, NGOs and the civil society. • Develop a deliberative and science based platform for a stakeholder dialogue in Europe and beyond in this area. The main elements of the platform are: o a) the content, o b) the participants, o c) the physical and technical solutions and arenas and - at last o d) the responsibility for a permanent platform. • Formulate Recommendation for research and political actions. The work packages of the project will more or less mirror this structure. We will combine desk research, qualitative interviews and workshops to meet the challenges of these objectives.

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**NBR: 217979** **ACRONYM: TOPCRYST** **EC FUND: 514764**

**DG:** REA **Call: FP7-PEOPLE-2007-3-1-IAPP** **Thema:** PEOPLE-2007-3-1-IAPP

**Title:** Novel tools for crystallisation of macromolecules

**Abstract:** The elucidation of 3-dimensional structures of proteins and other biological macromolecules and complexes is essential for rational drug design, targeting and delivery, biocatalysis, the design of environmentally friendly agrochemicals, the development of biosensors and other nanobiotechnological applications. The most powerful tool for structural analysis is X-ray crystallography, which crucially depends on growth of high diffraction quality crystals. Crystallisation is the least controllable and usually rate-limiting step of the process that goes from cloning a gene to using the structural information for predicting and designing function. TOPCRYST, an academia-

industry project, will use Dual Polarimetric Interferometry, pioneered by Farfield Scientific Ltd., to probe crystallisation at its earliest, most crucial stages. This will allow to predict the outcome of crystallisation trials when they are still at their earliest stages and thus to rationally design such experiments in order to lead them to the desired result, i.e. well-diffracting crystals. Transfer of knowledge between academia and industry will tackle the problem of detecting crystal nucleation phenomena at the very earliest stages of crystallisation and holds a number of promises that will be investigated in its course: (i) to guide the choice of pH and buffer, temperature, precipitating agent, additive(s) etc, starting from a limited number of preliminary experiments, thus obviating the need for extensive screening; (ii) to allow to unequivocally distinguish crystalline from amorphous material, something which is not always easy even for an experienced crystalliser, with obvious possibilities of extension to high-throughput environments; (iii) to allow optimisation of conditions under real-time control; (iv) to provide an experimental underpinning to the theoretical understanding of nucleation phenomena (v) to develop novel instrumentation for crystallisation of macromolecules.

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**NBR: 217993** **ACRONYM: FESTOS** **EC FUND: 824552**

**DG:** REA **Call: FP7-SEC-2007-1** **Thema:** SEC-2007-6.3-01

**Title:** Foresight of Evolving Security Threats Posed by Emerging Technologies

**Abstract:** The FESTOS goal is to identify and assess evolving security threats posed by abuse or inadequate use of emerging technologies and new S&T knowledge, and to propose means to reduce their likelihood. Almost all such knowledge can be abused or cause damage through inadequate use. In a free society this should not hinder free generation and exchange of knowledge. As the pace of science-based development accelerates, there is a pressing need for continual scanning of the unfolding technology landscape for potential security threats. Looking ahead to 2030, the foresight study will identify and assess security threats that could stem from future technologies. Robotics, Cognition, New Materials, Nano and Biotechnologies are some of the fields to be scanned. FESTOS will stimulate an "out of the box" anticipatory thinking and construct threat scenarios by analysing the impact of the identified threats on the background of envisioned “security climates” (societal context of security issues). The threat scenarios will be evaluated in terms of their levels of impact and uncertainty. In conjunction with each scenarios critical early-warning indicators will be identified, namely signals that hint at a growing likelihood of specific scenarios and thus provide basis for possible prevention means. Societal issues will be discussed, as well as the controversial issue of controlled dissemination of scientific knowledge in the context of necessary trade-offs between security and the freedom of research and knowledge. Finally policy recommendations will be derived, aiming at novel means of preparedness. Adequate mix of Foresight methods will be employed, e.g. horizon scanning, weak signals analysis, expert surveys, brainstormings, “futures wheel”, interactive scenario building, STEEPV analysis. Key

European stakeholders are addressed in the project's dissemination plan. The impact of successful foresight in FESTOS could be the initiation of a continuous anticipatory process in Europe.

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**NBR: 218068** **ACRONYM: IMETI** **EC FUND: 1806477**

**DG:** REA **Call: FP7-PEOPLE-2007-3-1-IAPP** **Thema:** PEOPLE-2007-3-1-IAPP

**Title:** Implementation of Membrane Technology to Industry

**Abstract:** The IMeTI proposal aims to create a programme of applied research for implementation of membrane technology into industry based on experience and knowledge transfer between Academia and Industry. New membranes with improved chemical stability in a wide range of solvents, and better controlled cutoff properties and commercially viable membranes with high selectivity and flux for gas separations will be developed. The overall scientific and technical aim of the IMeTI project is to make important paradigm shifts in organic solvent nanofiltration and high temperature gas separation/purification, using cutting edge technologies based on membranes. The project involves the integration of the invention of new membranes and applications in the University/ Research Institute Partners with the subsequent development of the necessary membrane technology up to processing scale by the SMEs. A key feature of this project will be the interdisciplinary nature of the Partners, and the fact that they bring inter-sectorial competence to the network. We aim to create widely applicable, scalable, high performance process techniques and technologies. The knowledge transfer and training programme involves Early Stage Researchers (ESR), at both university and industrial partners, each of whom gain high quality experience through combination of local and network wide research experience. Experienced Researchers (ER) will provide in depth knowledge, and will assist in mentoring the ESR. Visiting scientists will provide expertise from outside the network. In addition to their individual research, ESR and ER will increase their research capacity and knowledge through attendance of high level research conferences and workshops. IMeTI seeks to contribute to improving the European knowledge supply chain through this industry-academia programme of applied research aimed at developing engineers and scientists who are academically excellent and industrially experienced.

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**NBR: 218075** **ACRONYM: ACAPOLY** **EC FUND: 521706**

**DG:** REA **Call: FP7-PEOPLE-2007-3-1-IAPP** **Thema:** PEOPLE-2007-3-1-IAPP

**Title:** Academia and Company collaboration and technology transfer in Advanced POLYmers

**Abstract:** ACAPOLY is a partnership between micro resist technology GmbH and EPFL-LMIS1 whose main objective is the development of a new set of polymer materials for MEMS/NEMS technologies with an associated process library. The materials that the partnership has planned to develop are Ormocer and SU-8. The objective is to modify both materials in a way that they can be processed using Electron Beam Lithography, Direct Laser Writing, UV-Nano Imprint Lithography and Ink-Jet printing. The developed materials and process libraries will be used to fabricate UV-NIL stamps, large arrays of LEDs for automobiles and large arrays of optical waveguides.

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**NBR: 218111** **ACRONYM: NANOSOURCE** **EC FUND: 1132425**

**DG:** REA **Call: FP7-PEOPLE-2007-3-1-IAPP** **Thema:** PEOPLE-2007-3-1-IAPP

**Title:** METALLIC AND SEMICONDUCTING NANOPARTICLE SOURCE FOR ELECTRONIC AND OPTOELECTRONIC APPLICATIONS

**Abstract:** The proposal aims at mutual technology transfer between two academic research laboratories and an industrial partner. NTUA has experience on sensors and electronic/optoelectronic devices based on nanoparticles arrays, NCSRD has experience on the nanoscale characterization of materials and microelectronic device fabrication technologies and MANTIS Deposition Ltd has developed a nanoparticle source able to synthesize nanoparticles of extreme size uniformity. A main scientific goal of the project is the formation of 2-dimentional and 1-D configurations of nanoparticles with controlled size and density. The accomplishment of this target will enable the fabrication of nanoparticle based sensors and electronic/optoelectronic devices beyond the state-of-the-art. The academic partners will have the opportunity to advance their research in the above fields by acquiring knowledge in the nanoparticle manufacturing technique of Mantis. From this exchange of knowledge the SME will benefit from the investigation of its product applicability in these new fields. The complementarity of know-how of the partners which extends from the nanoparticles to electronic sensors and devices fabrication technologies supported by the characterization of electronic, optical and structural properties of materials used it is a solid background for the partners to further develop their research agenda through mutual transfer of technology.

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**NBR: 218138** **ACRONYM: FRESP** **EC FUND: 3029967**

**DG:** REA **Call: FP7-SEC-2007-1** **Thema:** SEC-2007-4.3-03

**Title:** Advanced first response respiratory protection.

**Abstract:** In the current state of technology, individual respiratory protection for first responders consists primarily in a gas mask and an activated carbon filter. Filters protect either against chemical warfare agents, either against (a part of the) toxic industrial chemicals. Combined filters exist, but with limited efficiency and a high burden for the wearer (breathing resistance, canister weight,…). These filters are also sensitive to the deleterious influence of the water vapour present in the ambient air. Biological protection is solely provided by the aerosol pre-filter. The purpose of this activity is to develop new nanoporous adsorbents that offer a sufficient protection for a wide range of toxic chemicals (industrial and military) and biological threats, under severe and wide-range environmental conditions. For quick response in case of a chemical or biological incident the same adsorbent will be incorporated in a hood. Thus offering a short-time, but quickly operational, respiratory protection to first responders and the public.

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**NBR: 218282** **ACRONYM: ICPCNANONET** **EC FUND: 1355447**

**DG:** RTD **Call: FP7-NMP-2007-CSA-1** **Thema:** NMP-2007-1.1-3

**Title:** A web-based repository of nanoscience and nanotechnology publications, database of researchers and online forum, to inform and facilitate networking between EU and ICPC RTD

**Abstract:** The ICPCNanoNet project aims to provide an electronic archive of nanoscience and nanotechnology research publications and support the networking of researchers in the EU and ICPC. The electronic archive will be based on open-source software (EPrints) that is widely used by scientific institutions across the globe, and allows the incorporation of full-text open access publications (submitted by authors themselves) and the incorporation of entries from other publicly available sources (including other open-access repositories, electronic tables of contents and abstracts). This will facilitate researcher access to new data and the identification of groups that are performing complementary research for potential collaboration. ICPCNanoNet will also establish a database of researchers and organizations in the EU and ICPC, which will include contact details, research interests and expertise. This database will be available to all registered users of the website, allowing researchers to search for individuals that have specific expertise and organizations that have desired instrumentation and capacity. Researchers will be able to contact each other through an internal mail forwarding system and online discussion fora. It will identify research strategies and organization activities within the eight ICPC regions: Africa; Caribbean; Pacific; Asia; Eastern Europe and Central Asia; Latin America; Mediterranean Partner Countries; and Western Balkan Countries. These will be reported on an annual basis and available to download from the website. It will actively network EU and ICPC researchers through annual workshops, to be held in the EU; China; India; and Russia, and through the webcasting of these workshops and separate online workshops, where wider participation can be achieved.

**NBR: 218329** **ACRONYM: SPINAPPS** **EC FUND: 519776**

**DG:** REA **Call: FP7-PEOPLE-2007-3-1-IAPP** **Thema:** PEOPLE-2007-3-1-IAPP

**Title:** Spin Torque Oscillators for Wireless and Radar Applications

**Abstract:** Nanoelectronics will pave the way for industrial innovation in Europe in the next decade, and novel nanoelectronics areas such as spintronics offers solutions to many current problems by means of smaller, lighter, faster and better performing materials, components and systems. Applied spintronics is expected to make some essential contributions to solving increasingly acute problems of miniaturization in the wireless marketplace. It promises to deliver wireless devices that combine all common radio standards while keep power consumption to a minimum. It makes possible life-saving vehicle radar systems at a fraction of the prize of today's systems. A huge positive impact on the safety and security of the European citizen is expected. The core technology of our SpinApps proposal is the Spin Torque Oscillator (STO). By utilizing a novel technology similar to that used in the recently introduced magnetoresistive read access memory (MRAM), a sub-micron radio frequency oscillator can be realized, with a wide operating frequency range and without any of the limitations of the classical oscillator circuit. This IAPP project bring together highly driven Euroepan researchers and engineers from Sweden's largest technological university and a laureated French start-up company. This unique combination offers the possibility to bridge the gap between laboratory demonstrations and commercial applications. It connects two different regions, two different sectors and promotes knowledge transfer across both borders. The SpinApps IAPP is the kind of project that Europe needs to stay competitive through constant innovation. Where large companies often cannot introduce the necessary disruptive technologies, SMEs and start-up companies must collaborate with universities to fill in in their place.

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**NBR: 218331** **ACRONYM: NAPOLYNET** **EC FUND: 1199986**

**DG:** RTD **Call: FP7-NMP-2007-CSA-1** **Thema:** NMP-2007-2.1-3

**Title:** Setting up research intensive clusters across the EU on characterization of polymer nanostructures

**Abstract:** NaPolyNet is a 36-month project involving 16 partners from 10 European countries. The objectives are: 1. to network at regional, national and international level with experts on the characterization of polymer nanostructured materials in the field of packaging, textiles and membranes, bridging the gap between scientific and engineering

approaches for the improved understanding of the structure-performance correlation in polymer devices; 2. to facilitate transnational access to important and unique equipment and to train young scientists and SMEs technologists; 3. to harmonize the work necessary for new standards in the field of characterization of polymer nanostructures for packaging, textiles and membranes. NaPolyNet will also focus on latest findings for managing the safety implications of polymer nanostructure along the life-cycle of those products. The activities are grouped into 7 work-packages (WP): After setting up the procedures for managing the project (WP1), the team will map the competences in the different fields of characterization of polymer nanostructures and will set up an European Open Laboratory (EOL) open to outside the consortium partners (WP2) incorporating the best and novel characterization methodologies and expertises. The EOL will be the base of the demonstration activities planned in WP3 and for the activities reported in WP4 that aims at making soon available experimental and theoretical strategies and routines in developing stage at the EOL location. This will allow average trained users of equipment for thermal, structural, morphological, mechanical characterization to produce reliable data on nanostructured materials and correctly interpret them. An International Workshop is planned on processing-structure-dynamics and properties of polymer nanostructures (WP5) in order to further support development and design of intrinsically safe nanomaterials. WP6 is completely dedicated to harmonize the work for preparation of new standards for polymeric nanomaterials characterization. WP7 aims at disseminating, knowledge-transfer and reporting with the purpose of giving the project a significant impact beyond the consortium participants and contributing to overcome barriers to the industrial application of polymer nanostructured materials especially in SMEs.

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**NBR: 218433** **ACRONYM: ENRHES** **EC FUND: 199938**

**DG:** RTD **Call: FP7-NMP-2007-CSA-1** **Thema:** NMP-2007-1.3-3

**Title:** Engineered Nanoparticles: Review of Health and Environmental Safety

**Abstract:** The overall aim of the ENRHES project is to perform a comprehensive scientific review of the health and environmental safety of fullerenes, CNTs, metal and metal oxide nanomaterials. The review will consider sources, pathways of exposure, the health and environmental outcomes of concern, in the context informing the regulation of the potential risks of engineered nanoparticles. We will employ a standardised information management strategy and a matrix approach to maximise the gain to partners and beneficiaries involved with the review. The specific objectives will be to review information on: § production, use and exposure to the target engineered nanomaterials § persistence, bioaccumulation and interactions of the engineered nanoparticles in living & environmental systems; § differences in toxicity posed by variations in size, type and chemical composition. On the basis of the review, prioritised recommendations on each of the above points will be developed and set in the context of informing policy makers

in the development of methods to address exposure as it relates to the potential hazards posed by engineered nanoparticles, and in the development of appropriate regulation.

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**NBR: 218528** **ACRONYM: OBSERVATORYNANO** **EC FUND: 3999840**

**DG:** RTD **Call: FP7-NMP-2007-CSA-1** **Thema:** NMP-2007-1.1-4

**Title:** European observatory for science-based and economic expert analysis of nanotechnologies, cognisant of barriers and risks, to engage with relevant stakeholders regarding benefits and opportunities.

**Abstract:** observatoryNANO brings together leading EU organizations who collectively have expertise in the technological; economic; societal/ethical; health, safety, and environmental analysis of nanotechnologies. Its primary aim is to develop appropriate methodologies to link scientific and technological development of nanotechnologies with socio-economic impacts. Both of these aspects will be enhanced by expert opinion, making this project unique in providing relevant web-based reports in a common format across all sectors, considered by all criteria, and widely publicized. observatoryNANO will become an industry leading and opinion forming catalyst for nanotechnology in the EU. The purpose is to avoid the exaggerated socio-economic impact of nanotechnologies and place developments in a realistic time-frame. It will present a reliable, complete, and responsible science-based and economic expert analysis of peer-reviewed literature, patents, national funding strategies, investment trends, and markets; in combination with information derived from questionnaires, interviews and workshops with academic and industry leaders, investors, and other key stakeholders. It will place these developments in the context of potential ethical and societal issues, and risks to human health and the environment, through its own analysis and through engagement with other actors, to ensure that its recommendations are balanced and contribute to the safe and responsible development of nanotechnologies. It will collaborate with all appropriate organizations including the EPO, OECD, industry associations, ETPs, and other EU-funded projects. Through these activities observatoryNANO will form a balanced governing board of key EU stakeholders. It will react to advice and input from these stakeholders, and advise on potential opportunities, barriers, and risks. This will allow decision-makers to take appropriate action to ensure that nanotechnology developments are realized as socio-economic benefits.

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**NBR: 218539** **ACRONYM: NANOIMPACTNET** **EC FUND: 1999960**

**DG:** RTD **Call: FP7-NMP-2007-CSA-1** **Thema:** NMP-2007-1.3-5

**Title:** European Network on the Health and Environmental Impact of Nanomaterials

**Abstract:** Recent technological advances allow the targeted production of objects and materials in the nanoscale (smaller than 100 nm). Nanomaterials have chemical, physical and bioactive characteristics, which are different from those of larger entities of the same materials. Nanoparticles can pass through body barriers. This is interesting for medical applications, but it raises concerns about their health and environmental impact. The objective of the NanoImpactNet is to create a scientific basis to ensure the safe and responsible development of engineered nanoparticles and nanotechnology-based materials and products, and to support the definition of regulatory measures and implementation of legislation in Europe. It includes a strong two-way communication to ensure efficient dissemination of information to stakeholders and the European Commission, while at the same time obtaining input from the stakeholders about their needs and concerns. The work plan shows six work packages (WPs: Human hazards and exposures, Hazards and fate of nanomaterials in the environment, Impact assessment, Communication, Integration and nomenclature, and Coordination and management). The work plan will be implemented over four years. Discussions about strategies and methodologies will be initiated through well-prepared workshops covering the WP topics. External researchers and stakeholders will be invited to participate. After these workshops, the researchers will collaborate to produce thorough reports and sets of guidelines reflecting the consensus reached. All of the leading European research groups with activities in nanosafety, nanorisk assessment, and nanotoxicology are represented in NanoImpactNet. All exposure routes, major disease classes and impact assessment approaches are represented within the network. It will coordinate activities within Europe. It will help implement the EU Actionplan for Nanotechnology and support a responsible and safe development of nanotechnologies in Europe.

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**NBR: 218570** **ACRONYM: NANOCHARM** **EC FUND: 1200000**

**DG:** RTD **Call: FP7-NMP-2007-CSA-1** **Thema:** NMP-2007-2.1-3

**Title:** MULTIFUNCTIONAL NANOMATERIALS CHARACTERISATION EXPLOITING ELLIPSOMETRY and POLARIMETRY

**Abstract:** Ellipsometry and polarimetry have enormous capabilities for characterization of multifunctional materials, devices, processing and phenomena at the nanoscale, with consideration of the nanostructure-properties-functionality relationship, which can be addressed non-destructively, non-invasively, in non-contact, in-line and in real-time without any specific condition requirements for measurements and without any sort of environmental impact. This Coordination action is aimed at expressing, assessing and spreading capability of ellipsometry/polarimetry in serving nanomaterial scientists, producers and end-users to address complexity of a large variety of multifunctional nanostructures, hybrid systems, interface behaviours, surface-related phenomena,

molecular self-assembling: for all those systems, ellipsometry/polarimetry is beyond just dimension at the nanoscale yielding information on compositional, optical, electrical, magnetic characteristics associated to the specific nanostructure. This CA identify European expertise and establish a platform for (1) coordination of research on ellipsometry for a large variety of nanomaterials, devices and technologies (2) dissemination and development of actions to allow nanomaterials scientists, students, SMEs and end-users approaching and exploiting ellipsometry and polarimetry for designing nanomaterials and nanodevices with unexplored functionalities and for controlling/implementing related production technologies. Advantages that this CA include improvement of knowledge of chemical and physical properties of nanomaterials, new controlled procedures of production, and more sustainable products. The technological impact is huge involving the major production areas and industries of a developed economy such as health-(medicine, biotechnology), environment-(hazardous gas sensing-monitoring), energetics-(photovoltaics), components-(semiconductor, coating industries), which all produce and use multifunctional nanostructure

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**NBR: 218639** **ACRONYM: NHECD** **EC FUND: 1448228**

**DG:** RTD **Call: FP7-NMP-2007-CSA-1** **Thema:** NMP-2007-1.3-4

**Title:** Nano Health-Environment Commented Database

**Abstract:** We propose to use our recent advanced research results and build a novel and useful automatic database on the impact of nano-particles on health and environment, which will be hosted and maintained by a expert software company based in Europe. The strength and innovation is double folded: primarily in automatic extraction and understanding from free text, which is in particular suited to create a comprehensive database in the nano-particles area; and secondly creating automated tools for appropriate evolving ontology assisted by leaders in toxicity in Europe. The team has proven mathematical and computerized world level skills in the general area of Information Technology pertained to database, data warehouse and text mining on one hand, and in toxicity of nano-particles in particular on the other hand. The proposed database will be automatically and manually updated with state-of-the-art information, which will be automatically understood and extracted into a relational database and data warehouse that can be accessed by the public and agencies through the internet. These three tiers (information gathering, deep analysis, and presentation) will keep the database updated and easily used for complex queries. The database will serve a variety of communities, from regulators to scientists, companies, new activities and the general public with all aspects of toxicity from nano particles. The database and the internet site will also serve for expert information cooperation and exchange and for dissemmination of information in this evolving domain, which has huge potential applications, where toxicity should be considered in advance.

**NBR: 218659** **ACRONYM: NANOINDENT** **EC FUND: 496558**

**DG:** RTD **Call: FP7-NMP-2007-CSA-1** **Thema:** NMP-2007-2.1-3

**Title:** Creating and disseminating novel nanomechanical characterisation techniques and standards

**Abstract:** Our project aims to gather, improve, catalogue and present characterisation techniques, methods and equipment for nanomechanical testing. European-wide activities coordinated by a new virtual centre will improve existing nanoindentation metrology to reveal structure-properties relationship at the nano-scale. These methods are the only tools to characterise nanocomposite, nanolayer and interface mechanical behaviours in the nanometre range. This work will also lay down a solid base for subsequent efforts for defining and preparing new standards to support measurement technology in the field of nanomaterials characterisation. Steps include development of the classical and the dynamic nanoindentation method and its application to new fields, application of modified nano-indenters to new fields as scratching and wear measurement, firm and uniform determination of instrumental parameters and defining new standard samples for the new applications. The virtual centre will disseminate information based on a new "Nanocharacterisation database" built on two definite levels: on a broader level partners will inventory and process all novel nanocharacterisation techniques and, in narrower terms, they will concentrate on nanomechanical characterisation. This will be achieved through the synchronisation of efforts set around a core of round robins but the database will include data of other channels as parallel research work and literature recherché. Core activities comprise detailed dissemination activities. Indirect connections to the stakeholders by a webpage with a build-in interactive database will be complemented by direct events such as participation in workshops (oral and poster presentations), and regular technical reports in international journals. Activities above will lead to detailed descriptions of novel characterisation techniques. The development and definition of new standards and good practices will support design of intrinsically safe nanomaterials for wide industrial applications.

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**NBR: 218696** **ACRONYM: ECONAM** **EC FUND: 600000**

**DG:** RTD **Call: FP7-NMP-2007-CSA-1** **Thema:** NMP-2007-2.1-3

**Title:** Electromagntetic Characterization Of NAnostructured Materials (ECONAM)

**Abstract:** Nanostructured electromagnetic materials are rapidly maturing and become increasingly employed for design of the electronic and optical components, integrated circuits and

functional devices. A broad class of applications is based upon the specialised electromagnetic materials that provide the necessary functionality for electronic devices and constitute the physical layer of the technologies dealing with electromagnetic signals. For such applications, the electromagnetic parameters of materials are of the primary concern. Characterisation and metrology of the engineered nanostructured electromagnetic media have become the critical aspects of their development and utilisation in practical applications. The main project objective of this project is to consolidate efforts and bring coordination in the European work towards development, testing, and dissemination of methods and tools for electromagnetic characterisation and metrology of nanostructured composite materials. The main novel characterisation approaches are focused on intrinsically interrelated developments and harmonisation of the material phenomenological models, standardisation of characteristic parameters and measurement techniques for evaluating the specified parameters. The main impact will be in development and dissemination of novel techniques for electromagnetic characterization of nanostructured materials and preparation of standards in the field of nanomaterials characterisation. This will complement the known techniques for characterization in terms of particle and reactivity by developing unified approaches to characterization in terms of permittivity, permeability, chirality parameter, surface impedance, grid impedance and similar.

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**NBR: 218732** **ACRONYM: NANOMED ROUND TABLE** **EC FUND: 687135**

**DG:** RTD **Call: FP7-NMP-2007-CSA-1** **Thema:** NMP-2007-1.2-2

**Title:** Nanomedicine ethical, regulatory, social and economic environment

**Abstract:** The fundamental objective of this Round Table exercise is to respond substantially to the need for genuine engagement and involvement of all the key stakeholders (public and private) in the nanomedical field in preparing the groundwork for optimised and collective decision-making at the European level. Although very promising, nanomedicine may add new dimensions to many ethical, social and economic issues. It is of primary importance to understand its possible impacts and provide for stakeholders a well-organised forum. The Round Table will bring together representatives from the nanomedical sciences and technologies involved, industry, patient groups, regulatory bodies, health insurance and policy making, and experts on the ethical, regulatory, social, economic and public engagement and communication and issues. The goal will be to: - collect the most relevant information to be discussed of: - actual achievements and, separately, promises of nanomedical innovation - recommendations issued by the European Commission, Member States and exercises carried out by various national and international bodies - present these in a “user-friendly” format appropriate for each of the main stakeholder groups with questions to be discussed - carry out a consensual debate concluding with agreed recommendations between various positions The Round Table will have important impacts by: - establishing a clear set of recommendations to

support decision making at the European level - identifying priority areas for research and development and for societal actions - significantly enhancing the flow of knowledge reciprocally between each of the key stakeholder groups along the chain from research to patient - helping to reduce fragmentation in nanomedical research across Europe - contributing to mobilising additional public and private investment in nanomedical R&D in Europe - and overall thereby stimulating innovation in nanobiotechnologies for medical use

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**NBR: 218764** **ACRONYM: CO-NANOMET** **EC FUND: 995793**

**DG:** RTD **Call: FP7-NMP-2007-CSA-1** **Thema:** NMP-2007-1.2-4

**Title:** COordination of NANOMETrology in Europe

**Abstract:** Nanotechnology has the ability to become the most promising technology advance for the 21st Century. It offers a huge potential of applications and economic benefits, which may contribute to the European economy. Scientifically and economically, nano-metrology is an indispensible part for nanotechnology which must develop hand in hand with the developments of nano-science and –technology. The programme of work set out in this project will address the need within Europe to develop the required measurement frame to successfully support the development and economic exploitation of nanotechnology. A pan-European coordinated response to the emerging needs of nanotechnology defined required from the National Metrology Institutes to provide a suitable measurement framework for the effective commercial development of nanotechnology. To address this requirement a European Strategy Plan for Nanometrology will be delivered in consultation with key stakeholders. 5 European Action Groups in Nanometrology will be implemented to address the need to put in place a process chain for the dissemination of metrology techniques as well as traceability to national standards and internationally harmonised standard methods specific to the particular nanotechnology area addressed. Educational programmes addressing nanometrology across Europe will be reviewed, a future training needs analysis completed and recommendations for training curricula made. Training will be provided in basic nano metrology concepts as well as standardisation. European capabilities review will be completed and a directory published. Exisitng and future requirements for large infrastructures as well as capbility gaps will be assessed. Traceability and metrology in industry will also be addressed. This project will take input from a range of stakeholders including National Metrology Institutes, research institutes, industry, regualtory and standards bodies as well as the EC.

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**NBR: 218851** **ACRONYM: AGAPAC** **EC FUND: 1764628**

**DG:** REA **Call: FP7-SPACE-2007-1** **Thema:** SPA-2007-2.2-01

**Title:** Advanced GaN packaging

**Abstract:** On the very last months, the Gallium Nitride (GaN) technology has made a remarked breakthrough in the world of the microwave electronics with the announcement of commercially available transistors from 5W to 180W at microwave frequencies. Coming from major transistor industrial vendors from Japon but also from US, it let equipment manufacturers and especially the one from space think that time has come now for a rapid insertion into their systems. Outside the reliability and the European source concerns, these GaN power transistors will roughly increase power density by more than an order of magnitude for large devices (from 0.5 W/mm to 5 W/mm for space applications including deratings). The consequence will then directly impact the packaging technology for which the thermal resistance needs to be importantly reduced if the advantages obtained at die level want to remain at its highest at module and equipment level. To address this critical item for space satellite applications is the aim of the proposed project which is in the ESA roadmap [Ref. ESTEC/AC/418-20, ESA-IPC 2006] for GaN component strategy but not funded by ESA. The ESA funding is being mainly dedicated toward GaN transistor process optimization, reliability and industrialization. In this project, AGAPAC, which stands for "Advanced GaN Packaging", we want to establish a space compatible European supply chain for packaging solution of GaN HEMTs and GaN MMICs by 2010. To realize this project objective, we have defined sub-objectives which directly relate to 7 workpackages targeting: This project will extend beyond state of the art for high thermal dissipation composite (up to 600 W/mK) either based onto diamond or carbon nano-fiber compatible with hybride micropackage manufacturing technologies. The challenge remains in developing a space compatible power micropackage able to withstand up to 100 W of dissipated power when standard same size micropackage are around 25 W.

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**NBR: 218862** **ACRONYM: HPH.COM** **EC FUND: 3572011**

**DG:** REA **Call: FP7-SPACE-2007-1** **Thema:** SPA-2007-2.2-02

**Title:** HeliconPlasmaHydrazine.COmbinedMicro

**Abstract:** The objective of the research program is to design, optimize and develop a space plasma thruster based on helicon-radio-frequency technology and its application to a nano-satellite for attitude and position control. Moreover a detailed feasibility study will be also conducted to evaluate the possibility of using the plasma thruster to heat and decompose a secondary propellant. The feasibility study will asses the possibility of building up a combined-two-mode-thruster able to operate in the low-thrust high-efficiency plasma-mode and high-thrust low-efficiency secondary-propellant-plasma-enhanced mode. Only the plasma thruster will be developed and fully tested during this

study. The main characteristics of the thruster are: Power 50 W Weight within 1.5 kg Thrust >1.5 mN Specific Impulse (Isp) >1200 s The program will develop thought the following steps: a) Deep numerical-theoretical investigation through dedicated plasma-simulation tools. b) Extensive experimental campaign to validate codes, to investigate the physics phenomena involved and to proof thruster performance. c) The development of a thruster-prototype to be mounted on board of a mini-satellite to demonstrate technology feasibility, d)The study of all the critical issues related to the application to a mini-satellite e) the design and manufacturing of the mini-satellite mock up including all critical components f) analysis of scaling law to lower and higher power. As a final results of the project, a detailed analysis will be conducted in order to evaluate the possible application of the thruster in space missions requiring low thrust accurate attitude and position control.

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**NBR: 218993** **ACRONYM: NANOBAK** **EC FUND: 1430404**

**DG:** ENER **Call: FP7-ENERGY-2007-2-TREN** **Thema:** ENERGY-2007-8.1-03

**Title:** Novel climatic chamber with an Innovative, energy-saving Nano-Aerosol Humidificaction System for the manufacture of high quaity Bakery products

**Abstract:** The baking industry includes companies that make value added products including bread, buns, rolls, doughs, desserts, crusts, pastas, cookies, biscuits, crackers etc. that are either baked or frozen. The use of refrigeration technology has made a bakery's location independent of its customers, thereby broadening the geographic market potential and contributing to the growth of this sector. However, this development does have a cost. Bakeries are energy intensive, using large amounts of electricity and natural gas to operate the refrigeration system, compressed air system and ovens. These energy costs are rising and becoming a significant portion of the ingredient costs of baked goods. About 10% of the total electrical and thermal energy consumption of all craft enterprises originates from the bakery sector. Accordingly there are many possibilities for energy reduction and therefore to permanently reduce the costs for the enterprises and thus to make a sustainable contribution to climate protection. Making changes in the energy use patterns of bakeries would be the fastest way to affect the energy profile of bread, because bakery is responsible for 70 and 80% of the total energy consumption in conventional and organic bread production, respectively. Overall aim of the NanoBAK-Collaborative Project is the efficient energy management in the baking industry. Specific aim of this project is the development and demonstration of a novel marketable climatic chamber with an innovative, energy-saving nano-aerosol humidification system. Lab tests have shown that the energy consumption using ultrasonic humidification is significantly lower than for conventional humidification. The innovative ultrasonic humidification of the NanoBAK Project saves up to 50% of energy compared to conventional humidifiers. Furthermore the quality of the bakery goods is of high value, so that the ultrasonic humidifier is profitable both energetically and qualitative.

**NBR: 219305** **ACRONYM: MICRODROPCAT** **EC FUND: 157733**

**DG:** REA **Call: FP7-PEOPLE-2007-2-1-IEF** **Thema:** PEOPLE-2007-2-1.IEF

**Title:** Application of Droplet-Based Microfluidics for the Screening of Supramolecular Catalysts

**Abstract:** In this project we propose to develop new methodologies to prepare and screen large libraries of homogeneous catalysts based on supramolecular (self-assembled) ligands using droplet-based microfluidics. Presently, the discovery and design of efficient homogeneous catalysts still relies on time intensive trial-and-error methodology. To overcome these limitations, a new paradigm shift for the discovery of effective ligands relies on the supramolecular self-assembly of libraries of ligand through reversible non-covalent interactions. This significantly increases the potential chemical space within which an optimal ligand set can be found. The full potential of this methodology is impeded by current synthesis and screening techniques which rely on macroscale (mL) trial for all the ligands sets and reaction conditions. One effective strategy to increase the rate at which reactions can be performed at is through extensive miniaturization of the reaction vessel. Recent advances in droplet-based microfluidics have enabled the effective screening of reaction conditions on a nano- to pico- liter scale. We thus propose to develop, in collaboration with a lab-on-a-chip research group, a modular droplet-based microfluidic device which will enable the generation, within a nanoliter droplet, of supramolecular catalyst made up of self-assembled ligands around a transition metal. These catalytic droplets will then be merged with a stream of reactants to form a nanoliter-size reaction size vessel which will enable the catalytic activity of the self-assembled catalyst to be evaluated. The intended outcome of this project is to greatly accelerate the speed at which an active catalyst can be identified at. This will have a broad impact on the chemical community for which screening methodologies have become an integral part of the discovery process (e.g. drug discovery).

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**NBR: 219332** **ACRONYM: CAMBAR07** **EC FUND: 169390**

**DG:** REA **Call: FP7-PEOPLE-2007-2-1-IEF** **Thema:** PEOPLE-2007-2-1.IEF

**Title:** Large-area ordered arrays of semiconducting oxide nanowires as electrodes for nanostructured hybrid solar cells.

**Abstract:** The target of the present project is to fabricate high efficiency nanostructured hybrid solar cells in which the exciton recombination is strongly avoided by interface nanoengineering. The cells will be made in three main steps. First, large-area, ordered Anodised Aluminium Oxide (AAO) templates will be fabricated electrochemically onto

transparent conducting substrates. Order will be induced prior to the anodization of aluminium by pre-patternig using Focussed Ion Beam (FIB). In a second step, the ordered templates fabricated will be used for the synthesis of large-area arrays of aligned semiconducting oxide nanowires. The arrays will be synthesized by electrodeposition within the template pores and by later removal of the same. Finally, films of conducting organic materials will be deposited onto the nanowire arrays by classical methods such as spin-coating from solution or thermal evaporation. The structures and devices obtained after each of the steps will be thoroughly characterised and the final test device performance will be evaluated. There are many materials science issues which will be addressed for improving the efficiency of hybrid solar cells. In particular, reduction of recombination of photo-induced charges through control of arrangement and size of oxide nanostructured electrodes, understanding of charge transfer at inorganic/organic interface, and permeation of organic semiconductor into the oxide nanostructures.

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**NBR: 219346** **ACRONYM: TRIBO-SCALE** **EC FUND: 133393**

**DG:** REA **Call: FP7-PEOPLE-2007-4-1-IOF** **Thema:** PEOPLE-2007-4-1.IOF

**Title:** Development of an unified energy wear approach to quantify the wear rate from nano to macro contact size range: Application to the Fretting Wear Problem

**Abstract:** Wear induced by debris formation and ejection is becoming a critical problem in many industrial applications. Fretting wear associated to small oscillating sliding displacement is considered as a plague in many contacted systems submitted to vibrations loadings (aeronautics, energy, biotechnology, nanotechnologies etc …). Hence, there is a critical interest to formalize wear degradations and wear rates to predict the contact endurances. Unfortunately, the current formalisms (Archard's law etc …) are still empirical and can take into account the contact size effect. Developing a micro-macro description of fretting wear phenomena, the applicant has recently introduced an extended energy wear formulation which permits to take into account the contact size effect. However, there is now a critical interest to optimize this approach for micro-nano contact scales. Hence, the objective of this IOF project is to extend this research through a 14 months mobility at the Department of Materials Science & Engineering (Nanolab / Suresh group) of MIT (USA). By coupling experimental and modeling developments our common objective is to develop an unified wear approach to quantify the wear rate from nano to macro contact size ranges. In addition to this scientific objective, this IOF project will permit the acquisition of competencies on nano tribology and research management that will be transferred after the return phase to the LTDS-DFI group (France) headed by the applicant.

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**NBR: 219412** **ACRONYM: MICROPADS** **EC FUND: 171600**

**DG:** REA **Call: FP7-PEOPLE-2007-2-1-IEF** **Thema:** PEOPLE-2007-2-1.IEF

**Title:** New Micro-Robotic Systems featuring Piezoelectric Adaptive MicroStructures for Sensing and Actuating, with Associated Embedded Control.

**Abstract:** Adaptronics is a state of the art interdisciplinary area of research. It unites broad principles of structural mechanics, advanced material science (notably piezoelectric), actuation and sensing elements and embedded control technology. Adaptive systems are autonomous self-regulating mechanisms, able to adapt themselves over variations of environmental conditions. Innovative adaptronic systems intend to extend the framework of the possibilities with the development of new products within almost all ranges of the industry. The project focuses on one of the most promising applications of piezoelectric adaptive systems: microrobotics and micro-assembling systems for micrometric components. These systems require a very strict performance such as nanometer resolutions, millisecond response time etc. and the use of precise sensors is indispensable. But, until now, there does not exist a “perfect” sensor neither in industry nor in research, with convenient sizes, precision and dynamics for microrobotic applications. It appears very interesting and innovative to develop centi/millimeter active structures integrating on the same piezoelectric material both the actuating and the sensing functions with embedded control. Such smart systems could be designated as cost-effective, compact and multi-functional, since they handle carrying, sensory and actuating tasks at the same time. The subject of the proposed research is multi-disciplinary and seeks a series of specific approaches for improving the overall microrobotic performance. As described in the proposal, it touches several areas: mathematical modeling, multiphysics design, microtechnology, theory of automatic control and software development, according to host institution expertise and researcher career.

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**NBR: 219433** **ACRONYM: NANOSCI-EPLUS** **EC FUND: 6316233**

**DG:** RTD **Call: FP7-ERANET-2007-RTD** **Thema:** NMP-2007-1.1-5

**Title:** Transnational call for collaborative proposals in basic nanoscience research

**Abstract:** NanoSci-E+ aims at launching, managing and carrying out the follow-up of a transnational call for collaborative projects in the field of basic nanoscience research, with a thematic focus on the “interfacing of functional nano-objects”. In the first phase of the proposed project, the call itself will be implemented, following modalities similar to those used for the first call run by NanoSci-ERA in 2006, while procedures will be amended in order to cope with identified weaknesses. The call will be based on a two-

stage submission / evaluation procedure. The funding scheme will rely on a real (although partial) common pot to which a majority of countries will contribute. Mutualizing part of the budget permits to avoid trade-offs where the selection of projects would be determined by the availability of funds, in a manner detrimental to the objective of supporting the highest quality research. The second phase of the project will deal with the management of the call budget, the follow-up activities and the monitoring of the call impacts. Because of the direct involvement of national agencies, NanoSci-E+ should contribute to blur further the distinction between national and European programmes. It is expected to encourage researchers to "think European" since their agencies give them the opportunity to finance indifferently national or transnational projects. The class of projects that can possibly fit within the scope of the planned call is clearly transverse to many "disciplines" of nanoscience and therefore accessible for the researchers of all the participating countries. In the same time, the topic is ambitious enough and resolutely forward-looking to make necessary a circulation of ideas, competencies and talents as well as a dialogue between different scientific approaches (inter-disciplinarity). It is expected that these two ingredients make transnational collaborations on the proposed topic both likely and meeting a crucial need of the nanoscience community.

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**NBR: 219483** **ACRONYM: P NANOPARTICLES** **EC FUND: 171600**

**DG:** REA **Call: FP7-PEOPLE-2007-2-1-IEF** **Thema:** PEOPLE-2007-2-1.IEF

**Title:** P4 as precursor for metal phosphide nanoparticles and N2 activation and reduction to organic derivatives.

**Abstract:** There are two different aspects in the project: i) the use of P4 in the synthesis of nanocristals of metal-phosphide and ii) fixation and activation of nitrogen and its reduction to organic derivatives. i) Synthesis of nanocrystals MxPy Usually the syntheses of these species imply the thermal decomposition (at high temperature) of a metallic precursor and a P atom donor in the presence of a mixture of a solvent/ligand. Normally P atom donor is TOP ligand. The main objective of our project is the use of more efficient P atom donor like P4. As starting point the synthesis of Ni2P and InP particles would be attempt due the expected properties for them (catalyst for olefine polymerization for Ni2P and optoelectronic and biology for imaging for InP) but the procedure will be extended to other metals like Pd, Pt or Ga. ii) Nitrogen activation The transformation of N2 into nitrogen containing species is a formidable challenge for chemists. The prerequisite for such transformation is the coordination then activation of N2 onto a metal complex. The Haber Bosch process allows the formation of NH3 from N2 an H2 but the conditions employed are quite hard and it is performed on a heterogeneous support. The second part of the project we propose to carry out involves homogeneous metal complexes together with silyl radicals and the use of nanoparticules for N2 activation. We are going to use for homogenous N2 activation a

Mo(0) compound stabilized by ligands which would not decompose by the presence of reducing agent. The starting point is the reaction of [Mo(dppe)2(N2)2] with very bulky silyl derivatives to put in evidence the involvement of radicals in the process.

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**NBR: 219573** **ACRONYM: HOT SHOT** **EC FUND: 169390**

**DG:** REA **Call: FP7-PEOPLE-2007-2-1-IEF** **Thema:** PEOPLE-2007-2-1.IEF

**Title:** Rationally Designed Supramolecular Bio-inorganic Hydrogels for Tumour Therapy

**Abstract:** Almost 2 million people in Europe are diagnosed with cancer each year, over half of whom die within 5 years as a consequence. Cancer has been designed by the ESF as one of the priority targets for the development of new technologies. The side effects and poor efficacy of today's treatments mean there is a pressing need for new innovative multifunctional drug carriers able to specifically target tumours and decrease patient morbidity. HOT SHOT is a multidisciplinary project which proposes such a novel drug delivery approach based on highly engineered nano-materials. The drug carriers will consist of composite hydrogels made of protein-resistant polymer molecules cross linked together by rationally designed self-assembled peptide strands which can disassemble in response to stimuli such as defined temperature and pH transitions. Gold nanorods or nanoshells will be covalently bound to the termini of the peptide strands and embedded within the hydrogels. Thanks to the innovative design and attractive chemical and physical properties of the components, the drug carriers will possess notable properties: a) drug delivery specifically to tumours by means of enhanced permeability of tumoral vascular system to nano-sized hydrogel beads; b) drug release on demand or in response to exact local conditions (i.e. lower pH of the tumoral tissue with respect to blood); c) gold nanoshells and nanorods acting as contrast agents in tumour tomography imaging and d) as heat sources for tumour thermal ablation therapy when irradiated with near-infrared light. HOT SHOT will contribute to the creation of a multidisciplinary network of research groups within Europe in which the fellow will be embedded and experience excellent collaborations. It will provide the fellow with intense multidisciplinary scientific training and significant results in medical and engineering research and thereby an exceptional opportunity to attain professional maturity.

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**NBR: 219582** **ACRONYM: FEMTONANO** **EC FUND: 86083**

**DG:** REA **Call: FP7-PEOPLE-2007-4-2-IIF** **Thema:** PEOPLE-2007-4-2.IIF

**Title:** Femtosecond laser induced nanoclusters in glasses for photonic applications

**Abstract:** Lately composite materials containing metal nanoparticules have found an increasing number of applications in different fields of science and technology. In particular glasses containing metallic nanoparticules are of great interest for photonics because of their unique linear and nonlinear optical properties, which are determined by surface plasma oscillations of the metal clusters. The surface plasmon resonance depends strongly on shape, distribution and concentration of the nanoparticules, as well as on the surrounding dielectric matrix. This offers the opportunity to manufacture very promising new nonlinear materials, nanodevices and optical elements by manipulation of the nanostructural properties of the composite medium. Recently, laser-based techniques leading to modifications of shape and size of the metal clusters have increasingly become of great interest and proved to provide a very powerful and flexible tool to control and optimize the linear and nonlinear optical properties of such materials. More generally, this technique allows the engineering of the optical properties of the material via gaining control over the spatial distribution of nanoparticules in the glass matrix. The possibility to 3D spatially structure the linear and non-linear properties of various materials leads thus to consider femtosecond laser as a fantastic tool. However, a deeper understanding of the light-matter interaction, with emphasis on multiphotons processes, is profoundly needed for the development of new optical devices based on nanoparticules mastering. This proposal is thus dedicated to 1/ to understand the processes of the formation of metallic nanostructures in glassy media and 2/ to manipulate, to master the nanocluster shape and mostly distribution within the dielectric matrix. This will allow structuring the non-linear properties in the dielectric matrix on demand.

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**NBR: 219588** **ACRONYM: LINKRINGS** **EC FUND: 178874**

**DG:** REA **Call: FP7-PEOPLE-2007-4-2-IIF** **Thema:** PEOPLE-2007-4-3.IRG

**Title:** LINKING RINGS INTO COMPLEX STRUCTURES

**Abstract:** The project is to link chemically controlled nanoobjects into new types of material. Specifically, a class of molecular magnet called "antiferromagnetic rings" can be functionalised such that through chemistry we can produce arrays of such rings. Initially we will target dimeric structures, where two such rings will be linked through a switchable group. Such structures have been proposed as possible two-Qubit quantum gates for quantum information processing. In the latter part of the project we will extend this work to produce larger supramolecular assemblies, using antiferromagnetic rings as building blocks. The materials, once made, will be studied using a range of physical techniques, including magnetic susceptiblity measurements, EPR spectroscopy and photophysical studies in Manchester, and more complex magnetic characterisation with European collaborators.

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**NBR: 219632** **ACRONYM: SSM-ILOPSH** **EC FUND: 178163**

**DG:** REA **Call: FP7-PEOPLE-2007-2-1-IEF** **Thema:** PEOPLE-2007-2-1.IEF

**Title:** Single spin manipulation in locally oxidized p-type semiconductor heterostructures

**Abstract:** Exploring the different relaxation mechanisms leading to spin decoherence and thus the realization of long spin lifetimes in single electron nanodevices is one of the central issues in nowadays spintronics. Although such effects have been widely studied in 2DEG-based nano-constrictions, the possibility of the utilization of stronger correlation phenomena characteristic to valence band holes on the transport properties of confined 2DHG systems has remained still unexplored. Recently it has become possible to C-dope (100) AlGaAs heterostructures for high-mobility 2-dimensional hole gases (2DHG) showing clear signatures of the fractional quantum Hall effect. Such structures lend themselves for the fabrication of quantum wires, quantum point contacts and quantum dots, provided they can be grown close (less than 100 nm) to the sample surface and that stable charging configurations can be obtained. The host institute has pioneered the fabrication of nanostructures with local oxidation of semiconductor heterostructures by using the biased tip of an atomic force microscope (AFM). The host has already demonstrated that oxide lines lead to laterally insulating behavior separating the plane of the 2DHG into various electrically disconnected areas. The proposed project aims to develop novel schemes for determining spin-related material parameters (g-factor, spin-orbit coupling strength) in various AFM lithographically defined 2DHG nanostructures via transport measurements. This is essential in order to explore electron spin dynamics, decoherence and relaxation in quantum dot and double-dot semiconductor spin qubits, and to determine conditions for coherent transfer of spin in nano/micro-circuits as well as methods of detection of spin currents. These experiments help to understand and control the coherent spin states of individual charge carriers, which is fundamental for the field of quantum computation in a solid state environment.

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**NBR: 219665** **ACRONYM: BIOTIC** **EC FUND: 223288**

**DG:** REA **Call: FP7-PEOPLE-2007-2-1-IEF** **Thema:** PEOPLE-2007-2-1.IEF

**Title:** Biotechnical functionalization of (bio)polymeric textile surfaces

**Abstract:** The European textile industry, which is in transformation from labour intensive products to knowledge intensive products, has a great demand for innovative high-tech materials with special properties and added functionalities, like smart and biomedical textiles. Today's scientific challenge is to make the enormous potential of biotechnology for production and synthesis of textile materials with advanced functionalities an opportunity for the European industry. The general aim of the research is to

functionalise textile materials using modern biotechnology. The research will result in new, specific knowledge and technologies to create biotechnologically modified textile materials with unique properties. The application of functional textile (bio)polymers is typically in the field of medical, safety, care and signalling/detection but also in less obvious application areas such as e.g. tissue engineering and separation technology. Application of biotechnology is not just limited to biological materials; enzymes are able to modify synthetic materials as well. The research will be based on a concerted multi-disciplinary approach, resulting in a drastic increase of knowledge, thereby creating the possibility to produce biotechnologically functionalised materials with unique surface properties and functionalities. The research will focus on enzymatic grafting of functional groups on textile fibres, and specific enzymatic surface modification to obtain functional nano-structured surfaces. Control of enzymatic action at correct time and length scales is a prerequisite to achieve the desired functionalities. Therefore sophisticated technologies and processes will be explored in order to design novel production processes for textiles that exhibit the desired functionalities. The research will build upon expertise available at the department of Textiles at Ghent University and at biotechnological research groups at Ghent University, VIB and other European universities.

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**NBR: 219678** **ACRONYM: MACROMOLECULESATWORK** **EC FUND: 150802**

**DG:** REA **Call: FP7-PEOPLE-2007-2-1-IEF** **Thema:** PEOPLE-2007-2-1.IEF

**Title:** Unveiling the physics of cellular processes: new approaches to study macromolecules at work

**Abstract:** The objective of this proposal is to combine different computational methods to study the physics of specific cellular components and processes which involve biological macromolecules. We will especially concentrate on the study of polyelectrolye DNA chains and analogous biopolymers and will investigate on their interaction with cellular structures and on the mechanisms of modifications of their physical properties. The understanding gained will allow us to explore different cellular processes related to gene delivery such as self-assembly of cationic lipid-DNA complexes and membrane fusion, relevant because of their fundamental properties as well as their applications in the biomedical sector. To achieve this goal, it is necessary to reach time and length scales in which macromolecules evolve, a regime that is out of reach of standard modelling approaches. To this end, we intend to adopt and refine a new chemically-aware coarse grained scheme and use complementary state of the art modelling techniques such as atomistic molecular dynamics and unspecific coarse graining. In addition, supercomputing techniques and resources will be exploited to provide unique scientific insights. The proposal will benefit from the expertise in biomolecular studies of scientists at the Barcelona Biomedical Park (PRBB), which will guarantee feedback and a cross-field perspective to the management of the project and to the production and

interpretation of scientific results. This project is very relevant to the goals of the IEF activity of the people work programme because of its ingrained multidisciplinary character and because it directly targets key research areas indicated by the EU such as biotechnology and nanotechnology. The different training and research activities planned would increase and diversify the scientific competences of the fellow, leading him to a more independent and mature professional status on which to build his future career.

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**NBR: 219690** **ACRONYM: GAKO2007CA** **EC FUND: 224573**

**DG:** REA **Call: FP7-PEOPLE-2007-4-2-IIF** **Thema:** PEOPLE-2007-4-2.IIF

**Title:** Development of multiscale methods in planning of nano MEMS

**Abstract:** The mathematical multiscale theories intensively developed in the last decades and collected high potential of theoretical methods. These methods are not completely used in engineering, although there exists a great variety of arguments evidently related to problems treated by the multiscale theories. The aim of this project is to give a contribution for closing this "gap" through joint work of mathematicians, mechanics and engineers. The specific goal of the project is to develop multiscale methods in nanotechnologies with orientation to prediction of new effects in complex structures as nano MEMS (Micro-Electro-Mechanical Systems). We hope that the effects found not only will demonstrate effectiveness of mathematical multiscale theories as method solution of applied problems but will lead to design new structures, materials and devices.

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**NBR: 219706** **ACRONYM: ENHANCEMENT ETHICS** **EC FUND: 161225**

**DG:** REA **Call: FP7-PEOPLE-2007-2-1-IEF** **Thema:** PEOPLE-2007-2-1.IEF

**Title:** Ethical aspects of human enhancement and the ownership of biological material

**Abstract:** The main objectives of this project are (i) to address relevant ethical aspects of human enhancement from a virtue ethics perspective and (ii) to identify and explore the philosophical dimensions of ownership of biological material which are related to human enhancement. My host and supervisor will be Professor Julian Savulescu who is the director of 'The Oxford Uehiro Centre of Practical Ethics' and the director of 'The Program of Ethics and the New Biosciences in the 21st Century School' at University of Oxford. The project has strong interdisciplinary features and will involve: moral philosophy, ethics of technology, medical ethics, neuroethics, enhancement technology and jurisprudence. This broad approach is reflected in the choice of supervisor;

Professor Julian Savulescu is qualified in medicine, bioethics and analytic philosophy, as well as host organisation; The Uehiro Centre for Practical Ethics at Oxford University. In addition I will have the support of Dr. Roger Crisp, a specialist in ancient philosophy at St. Anne's College in Oxford and Professor Francois Berger, leader of the research group 'Brain nanomedicine group' at INSERM U836 at University of Grenoble in France. The research will result in a series of four (4) articles, intended for publication in peer-reviewed journals.

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**NBR: 219770** **ACRONYM: HESPERUS** **EC FUND: 162985**

**DG:** REA **Call: FP7-PEOPLE-2007-2-1-IEF** **Thema:** PEOPLE-2007-2-1.IEF

**Title:** Hierarchical self-assembly of electroactive supramolecular systems on pRe-patterned surfaces: multifunctional architectures for organic FETs

**Abstract:** HESPERUS aims at enabling cross-disciplinary training and research at the interface between Electrical Engineering, Supramolecular Chemistry, Materials- and Nano-Science and Physics. The overall goal of HESPERUS is to generate new scientific and technological knowledge by combining supramolecularly engineered nanostructures (SENs), mostly based on organic semiconductors, with tailor-made interfaces to textured solid substrates and electrodes, for fabricating prototypes of two-terminal devices (supramolecular wires) and three-terminal devices (field-effect transistors). The training and research objectives of HESPERUS are: 1. Surface texturing: derivatization of electrically conductive solid substrates and metallic nanostructures to achieve a full control over the surface work-function, wettability and adhesion, thus ultimately to be able to tune the self-assembly of electroactive molecules at surfaces into pre-programmed supramolecular assemblies. 2. Hierarchical self-organization on textured surface of multifunctional SENs based on electrically/optically active functionalized carbon-based (I) 2D nano-objects such as n- and p-type discotics (perylenediimide and hexabenzocoronene derivatives) and (II) polymeric multichromophoric architectures at surfaces on the functionalized substrates. 3. Nanochemistry and nanoprobes: Scanning probes (AFM, STM, KPFM, C-AFM) quantitative time and space resolved characterization of various physico chemical properties of SENs, in particular correlation between structural and electronic properties. 4. Fabrication of supramolecular wires and transistors: Measurement of charge mobility in SENs two- and three-terminal devices varying systematically the wire's (1) chemical composition, (2) conformation, (3) length and (4) doping.

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**NBR: 219828** **ACRONYM: LIGHT INDUCED SWITCH** **EC FUND: 82388**

**DG:** REA **Call: FP7-PEOPLE-2007-4-2-IIF** **Thema:** PEOPLE-2007-4-2.IIF

**Title:** Nanoporous Materials and Supramolecular Clusters for Light Induced Electronic Switches

**Abstract:** Molecular framework materials recently have been shown to possess immensely rich host-guest chemistry; their porous lattices are capable of highly selective host-guest properties that include reversible guest and ion exchange, heterogeneous catalysis, and gas storage and separation. It was realized that by further exploitation of the porous nature of metal-organic frameworks in combination with spin crossover centres, molecular sensing materials can be generated, whereby the spin crossover sites can be switched 'on', 'off' or altered by the presence, absence or exchange of solvent guest molecules. The challenge in this exciting new area is to generate such materials with a focus on real and timely application. Light is one of the most promising ways to reversibly direct and control the physical properties of organic and inorganic materials. Spin crossover materials are a convenient class of compounds to make this possible as they are known to exhibit a light induced transition from a low spin to metastable high spin state, and indeed can show infinite lifetimes of the high spin state under certain conditions. The overall object of this proposal is to develop inorganic nanoporous materials and supramolecular clusters which have inbuilt light initiated switches, in the form of iron(II) spin crossover centers, for use as optical switches and storage devices, molecular sensors, chemical detectors, drug delivery, data storage, displays and other electron devices. The project makes use of the complementary skills and expertise of the research groups in Bordeaux, Melbourne and Sydney to achieve the first detailed investigations of this novel co-existence of spin crossover and nanoporous materials towards 'nano-scale' light initiated switching applications. The impact of even a small advance in such materials could translate into a major impact on the environment, economy, public health and national security.

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**NBR: 219856** **ACRONYM: FENASY** **EC FUND: 120934**

**DG:** REA **Call: FP7-PEOPLE-2007-2-1-IEF** **Thema:** PEOPLE-2007-2-1.IEF

**Title:** Space and Time Resolved Ultrafast Dynamics of Few Porphyrins Derivatives in Nanosystems

**Abstract:** In this project (FENASY), we wish to study fast (picosecond regime, ps) and ultrafast (femtosecond regime, fs) dynamics of some (guests) porphyrins derivatives in solutions and confined in chemical and biological nanocavities and nanochannels provided by cyclodextrins, Human Serum Albumin protein, and MCM-41 zeolite. The guests and hosts are being used in different fields of Science and Technology. We will interrogate their photoreaction and relaxation dynamics and study the effect of nanoconfinement on the related and subsequent elementary events at both ps and fs time scales.

Powerful techniques based on ultrafast laser and single molecule technologies will be our tools to carry out FENASY. We will then focus on studying the relationship between the photodynamics (time domain) and nature and size of the formed nanostructure (space domain, nano to micrometer domain). The expected results will allow explaining the relaxation behaviour of these important molecules upon excitation to Soret and Q-bands, and the relationship to their photochemistry in solution and for the first time within chemical and biological nanocavities and nanochannels. We believe that the expected results will be of great interest to the scientific community in designing new derivatives of these and other systems for use in nanotechnology (nanoLED's, nanostwitches, etc), nanodrugs (nanophotodynamics therapy of cancer), and environmental science (heavy metal nanocleaning). Key words. Femtochemistry, single molecule fluorescence microscopy, porphyrins, nanocavity, cyclodextrins, protein, zeolites, dynamics, emission, absorption, nanotechnology, biotechnology, environmental science, photodynamic therapy.

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**NBR: 219913** **ACRONYM: NANOXID** **EC FUND: 178307**

**DG:** REA **Call: FP7-PEOPLE-2007-2-1-IEF** **Thema:** PEOPLE-2007-2-1.IEF

**Title:** NanoPorous Anodic Oxides for Functionalization of Metal Surfaces

**Abstract:** The project examines the mechanisms of formation of nanoporous anodic oxides. Nanoporous anodic oxides are important to the protection of metals against corrosion and wear. They have attracted renewed interest due to the potential for long range ordering of pores, with applications in nanotechnological systems. Currently, long-range pore order is achieved empirically. However, the proper understanding of growth mechanisms will enable systematic tailoring of oxide properties. The researcher will participate in a collaborative activity, involving the host organization, The University of Manchester, and Institut des NanoSciences de Paris, located within Universités Paris 7 et 6. The experimental work will focus on the relative contributions of oxide dissolution and oxide flow in the generation and ordering of pores. It will adopt tracer procedures, newly-developed in Manchester, with precise determination of compositions, morphologies and structures of porous oxides by a wide range of surface analytical and electron microscopy tools. These will include ion beam analyses, using facilities in Paris, with new methods of data analysis by multi-spectrum fitting. The researcher will be integrated into a large Light Metals activity, providing excellent opportunities for career development, including personal skills, networking, research management, supervision, and international collaboration. Further, the experimental programme provides a major diversification of the researcher's expertise and experience.

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**NBR: 219918** **ACRONYM: LEEP-NANO-ASTRO-RAD** **EC FUND: 243268**

**DG:** REA **Call: FP7-PEOPLE-2007-4-2-IIF** **Thema:** PEOPLE-2007-4-2.IIF

**Title:** Investigation of condensed-phase low-energy (0-30 eV) electron induced processes for application to nanolithography, astrochemistry and radiotherapy.

**Abstract:** In the past decade, it has become increasingly recognized that low-energy electrons (LEE) play a key role in a large number of fundamental and applied fields. Electrons with energies in the range 0-30 eV can induce, at interfaces and surfaces, specific reactions which are relevant to nanolithography, dielectric aging, radiation waste management, radiation processing, astrochemistry, planetary and atmospheric chemistry, surface photochemistry, radiobiology, and radiotherapy. For more than 30 years, the action of LEE at the surface of molecular and biomolecular solids has been investigated in the laboratory of the applicant with model systems consisting of pure or doped thin molecular films. The purpose of the present application is to develop a research program within the European Union (EU) to investigate systems of relevance to three important applications of LEE processing, namely nanolithography, astrochemsitry and radiotherapy. In particular we plan (1) To investigate LEE-induced reactions of selected molecules on metallic surfaces so as to assess their potential for STM beam lithography. (2) To study the possibility of inducing specific chemical reactions with the photoelectrons. (3)To investigate LEE-induced reactions in ice mantles that simulate both planetary and ISM conditions. (4)To investigate LEE-induced damage to DNA incorporating the radiosensitizers Carboplatin and Gemcitabine with and without added water. (5)To obtain cross sections for DNA damage with and without the presence of these radiosensitizers by analysing the dose to yields relationship during LEE bombardment of DNA. Since the IIF is one of world's leading researchers in such LEE processes it is also intended to exploit his fellowship to provide valuable training and leadership amongst the younger members of the EU LEE community at a time when a new generation of researchers is emerging in the field.

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**NBR: 220002** **ACRONYM: NANOCOAT** **EC FUND: 224989**

**DG:** REA **Call: FP7-PEOPLE-2007-4-2-IIF** **Thema:** PEOPLE-2007-4-2.IIF

**Title:** Development of Self-lubricating Nanocomposite Coatings impregnated with in-situ formed MoS2 for Tribological Applications

**Abstract:** Use of self-lubricated coatings in dynamic contacting parts of the system not only reduces complexity, weight, and cost to the system, but also improves the performance to a great extent by reducing friction and wear. Unlike liquid lubricants, the release of various toxic and harmful chemicals to the environment can also be avoided. So, a self-lubricated surface with a long lifetime is a promising one to meet future challenges. The most common solid lubricants are graphite and transition metals layered

dichalcogenides, among which MoS2/WS2 has a great prominence. In this proposal, electrodeposition of Co-W alloys impregnated with MoS2 and WC nanoparticles will be carried out to form nanocomposite coatings by a low cost electrodeposition process. The idea is to impart high hardness and mechanical strength by WC particles for wear resistance; and self-lubrication property by MoS2 particles to a Co-W matrix. Firstly, unlike ELECTROLYTIC CO-DEPOSITION from suspensions of MoS2 nanoparticles, here, emphasis will be on the in-situ formation of MoS2 particles in the electrical double layer followed by their incorporation into Co-W alloys during electrolytic reduction process. Secondly, R&D efforts will be directed to co-deposit WC particles from suspensions along with MoS2 to make self-lubricated wear-resistant nanocomposite coatings. The detailed mechanistic study of MoS2 nucleation and growth; the surface and structural characterization of the nanocomposite coatings, wear and friction property and corrosion will be investigated to understand the structure property correlation. Thirdly, the electrodeposition of Co-W+WC+IF-MoS2 nanocomposite coatings will be carried out from electrolytic suspensions of WC and IF-MoS2 nanoparticles, and the properties will be compared with the former nanocomposites. A special attention will be given on the onset of an implementation of this technology into industrial practice.

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**NBR: 220035** **ACRONYM: CACOPHOS** **EC FUND: 169957**

**DG:** REA **Call: FP7-PEOPLE-2007-4-2-IIF** **Thema:** PEOPLE-2007-4-2.IIF

**Title:** Cage Complexes With Phosphonates

**Abstract:** The proposal is to learn to use polymetallic cage complexes as building blocks for larger zero-dimensional nano-objects. The approach to be adopted will be to use phosphonate and related ligands to link these cages via a carboxylate displacement reaction that has been developed in Manchester. Once made these compounds will be studied by X-ray crystallography and their magnetic properties examined using a variety of techniques.

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**NBR: 220055** **ACRONYM: ESRCN** **EC FUND: 290980**

**DG:** REA **Call: FP7-PEOPLE-2007-2-1-IEF** **Thema:** PEOPLE-2007-2-1.IEF

**Title:** Effect of structure upon the reactivity of catalytic nanoparticles

**Abstract:** Heterogeneous catalysis is an area where nanotechnology is present in people's everyday lives. Catalytic processes are found in diverse applications such as fuel-refining, the petrochemical industry, fertiliser production, automotive catalytic converters, biochemistry etc. They also provide a pathway to renewable, clean energy in the form of hydrogen fuel cell technology. Most modern catalysts take the form of catalytically

active nanoparticles dispersed over some highly porous support medium. It is expected that the activity of these particles is largely determined by the density of catalytically active sites on the particle surface. The proposed research will establish a new methodology in nanocatalyst research by using high-resolution experimental techniques to establish a close and unambiguous correlation between the morphology and reactivity of individual nanoparticles. The principal tools will be scanning tunneling microscopy (STM), which offers atomic-scale structural resolution, combined with scanning Auger microscopy (SAM), offering nanometer-scale chemical information. These techniques will be used to measure the surface structure and composition of catalytic nanoparticles before, after and perhaps even during a reaction and to correlate this data with the reactivity of the nanoparticles measured by temperature programmed desorption (TPD). By measuring the surface structure of individual nanoparticles it will then be possible to make a direct comparison with the results of computational modeling. This will open the possibility to optimize the nanoparticle size and shape in order to maximize the number of catalytically active surface sites, while minimizing the unused volume, thereby improving the efficiency of the catalyst while reducing the material cost.

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**NBR: 220074** **ACRONYM: QDCN** **EC FUND: 159733**

**DG:** REA **Call: FP7-PEOPLE-2007-2-1-IEF** **Thema:** PEOPLE-2007-2-1.IEF

**Title:** Quantum Devices based on Carbon Nanotubes

**Abstract:** The aim of this project is to take advantage of the unique properties of carbon nanotubes (CNTs) for the fabrication of innovative nanoelectronic devices. The first nanodevice is a ultra-sensitive detector, designed to probe the electrical properties of individual molecules that are exposed to external perturbations, e.g. such as electric field or light. The detection scheme is based on an original approach, on the contrary to previous experiments which aimed at contacting individual organic molecules with two electrodes. With the two-electrode technique the problems have quickly appeared due to the poor control of the electrode/molecule interfaces. Here, the molecule is attached to only one electrode, a nanotube. The resistance of the nanotube is measured as a function of a gate voltage, which should be sensitive on the energy spectrum of the molecule. Low-current detection is expected to be particularly suitable for molecular electronics, since most of the molecular systems are highly resistive. This includes organic molecules, biological molecules, and semiconducting particles. Most importantly, such an approach is expected to be mostly independent on the quality of the molecule-nanotube interface, and in addition, it allows the device to be operational in higher temperature. The second proposed design of nanodevice is a non-volatile memory, which will be achieved also in one-electrode approach by combining a single nanoparticle (with diameters up to 10nm) with a carbon nanotube transistor. In the device, CNT acts as conduction channel and the charge stored in the nanoparticle

behaves as a floating-gate. Charging effects will be obtained either from an atomic force microscope or directly from the nanotube. The objective will be to determine the operability of the device at room temperature and its limitation (necessary charge on floating-gate, temperature limitation).

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**NBR: 220094** **ACRONYM: NANOTRAN** **EC FUND: 161792**

**DG:** REA **Call: FP7-PEOPLE-2007-2-1-IEF** **Thema:** PEOPLE-2007-2-1.IEF

**Title:** Theoretical study of electronic transport in carbon nanostructures and molecular wires

**Abstract:** The study of molecular nanostructures is in the forefront of research due to their high application potential as electronic components. Recently several theoretical groups have placed large effort into developing new tools to accurately describe the electronic properties of molecular nanostructures. This proposal aims to significantly advance the limits of current capabilities and provide the theoretical tools needed to underpin research in nanoelectronics on a five to ten years timescale. The proposed research focuses on the electronic properties of nanostructures, including single-molecule wires, carbon nanotubes, and other carbon nanostructures, such as functionalized graphene strips. The theoretical tools to be used are based on the non-equilibrium Green's function formalism and density functional theory (DFT). The recently-announced code SMEAGOL (Spin and Molecular Electronics in Atomically Generated Orbital Landscapes) developed by the host institution and collaborators is to be used for the study of transport properties. This code works in conjunction with the localized orbital based, linearly scaling DFT code SIESTA (Spanish Initiative for Electronic Simulations with Thousands of Atoms). Where necessary, these calculations are to be augmented with the plane-wave based VASP (Vienna ab initio simulation pakcage) code, which the applicant has vast experience with. One focus of the project is to incorporate electron-phonon interactions into the SMEAGOL code, to enable the study of room temperature transport properties. Successful completion of the research objectives will yield significant progress in the field of molecular electronics. The impact of the planned research may potentially influence the development of applied science in the European Union, as it may eventually boost the progress of research on possible applications in the field of molecular electronics.

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**NBR: 220108** **ACRONYM: SPIVOR** **EC FUND: 183468**

**DG:** REA **Call: FP7-PEOPLE-2007-4-2-IIF** **Thema:** PEOPLE-2007-4-2.IIF

**Title:** Geometrical aspects of spin and vortex dynamics in electromagnetic and matter waves

**Abstract:** The project is intended to reveal a unifying nature and fundamental geometrical features of the spin and vortex dynamics of classical electromagnetic and quantum-mechanical matter waves. The Berry phase, Magnus effect, and spin-Hall effect are attracting ever-increasing interest of scientists because of their potential applications in nano-physics, spintronics, quantum computing, etc. Simultaneously, the modern optics (including nano-optics, photonics, and plasmonics) offers unique possibilities to test and apply fundamental quantum-mechanical ideas within classical systems. The striking similarities of the spin and vortex dynamics in electromagnetic and matter waves call for an in-depth theoretical analysis which will be given within the framework of the present project. We will carry out extensive theoretical investigations of the propagation and scattering of electromagnetic waves in inhomogeneous and anisotropic media. A special attention will be paid to dynamics related to spin (polarization) and orbital (optical vortices) angular momenta of light. The research will be concentrated on various manifestations of spin-orbit-type interactions between intrinsic and extrinsic degrees of freedom of electromagnetic waves and quantum particles. We aim to develop a unifying theoretical approach to be able to describe specific features of behaviour of spins and vortices evolving in external fields. The approach will include the fundamental geometro-dynamical effects: the Berry phase, spin-Hall effect, and Magnus effect. Using scope of the host laboratory, we are going to perform experimental test of fine manifestations of these effects in classical optics, with potential applications to fiber optics, metamaterials, and remote sensing of turbulent atmosphere. We anticipate that realization of the project will contribute to the ability to control complex wave fields of different nature and, thus, will have a profound interdisciplinary impact and applications.

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**NBR: 220150** **ACRONYM: PEPINEN** **EC FUND: 168256**

**DG:** REA **Call: FP7-PEOPLE-2007-2-1-IEF** **Thema:** PEOPLE-2007-2-1.IEF

**Title:** Processing and Electron Probing Inorganic Nanostructures for Emerging Nanotechnologies

**Abstract:** Since their discovery carbon nanotubes have generated huge interest due to their one-dimensional nature and their unique physical properties. However, a number of serious obstacles stand in the way of using them as useful functional nanomaterials. They are in fact poorly dispersable in common solvents and generally produced in a wide range of electronic types, with separation by type proving difficult. In view of these issues attention is now moving towards inorganic alternatives. In this context nanowires made up of molybdenum, sulfur and iodine (MoSI) and WS2 nanotubes have been shown to be within the most promising. Easy fabrication readily scaled up for a range of compounds, uniformity in diameters and electronic type and functional properties very similar to carbon nanotubes are among their most important qualities. However, being new class of materials, they are yet to be extensively studied. A complete understanding indeed is

crucially required for further exploitation in the numerous technological applications they have been proposed for. The project aims to address crucial problems such as dispersability, processability and manipulation of these objects. Finding the optimal dispersion conditions will powerfully bring these materials on the technological and applicative scene. Once unlocked the solution processing issues other innovative and intriguing aspects will be covered, using the most advanced electron microscopy technologies to intimately understand the role of punctual structural defects in the ultimate physical properties of the materials. Correlation between physical properties and structural modifications will be for the first time established. The success of this proposal will give an important and unique contribute to the field, leading to technological innovations, community relevance and to a significant launch of the researcher, Dr. V. Nicolosi, in her first appointment in an advanced career at interdisciplinary level.

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**NBR: 220166** **ACRONYM: CAMMISP** **EC FUND: 216049**

**DG:** REA **Call: FP7-PEOPLE-2007-2-1-IEF** **Thema:** PEOPLE-2007-2-1.IEF

**Title:** Characterization of Applied Magnetic Materials for Industrial Scale Products

**Abstract:** The fundamental technology change towards using ferromagnetic structures with perpendicular anisotropy as storage media that worldwide hard disk drive industry has recently started, is generating a tremendous interest in the development of novel materials as well as characterization methodologies for perpendicular magnetic recording (PMR) applications. For the European research area and the European nanotechnologies industry it is imperative to gain worldwide leadership. A key factor in this direction is the professional training and career development of researchers with an enhanced competence and skill diversification encompassing fundamental physics and applied technology aspects. The main goal of the here proposed project is the professional training and career development of Dr. Vavassori, who will be provided with the knowledge and tools to tackle the scientific and technological challenges related to PMR media design and characterization. The project aims at achieving this goal by complementing the world-class expertise of the applicant in fundamental nano-magnetism and advanced magneto-optical tooling by supplementing it with additional knowledge of both applied physics quests and materials characterization methodologies related to PMR applications. The research training will be carried out using the world-class research facilities of the recently established nanoGUNE research centre and the long-standing experience of Dr. Berger, its lead scientific contributor, in the field of standard and innovative materials characterization for hard disk drives application. The inter-disciplinary expertise acquired during the research training will put him into an excellent position to build an entirely new research program and to effectively interface with leading industry researchers and developers in the future. This should strengthen

not just his own research portfolio, but also the European excellence and competitiveness in the field of applied nano-magnetism.

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**NBR: 220212** **ACRONYM: MACRO-CLEAN** **EC FUND: 171091**

**DG:** REA **Call: FP7-PEOPLE-2007-2-1-IEF** **Thema:** PEOPLE-2007-2-1.IEF

**Title:** Macroclean - developing novel gel-based technologies for water clean-up

**Abstract:** The management of contaminated groundwater, surface waters and drinking water is a major issue both in the EU and globally, where recent (and historical) industrial, urban and commercial activities have led to the presence of elevated concentrations of a wide range of contaminants in surface- and ground-waters, adversely affecting the health of millions of people. This has been recognised in a number of recent directives (e.g. the Water Framework Directive, the Groundwater Directive) aimed at protecting ground and surface water resources within the EU. However, despite much progress, groundwater and surface water quality is still highly variable across Europe, and there is an urgent need to develop and fully implement forward-looking technologies to clean-up water and keep it free from pollution. In this project we intend to combine innovative biomaterial / gel technologies with nanotechnologies to develop and commercialize innovative products for the remediation or clean-up of contaminated ground and surface waters. A range of permeable composite gels in which nanoparticles will be embedded will be produced and tested for application as water clean-up devices. Achieving the objectives of the project will benefit to all European citizens, economy, agriculture and industry and will place Europe in a leading position in the area of polymer-based remediation devices and technologies. This is an inter- and multidisciplinary proposal, which will offer a top class young researcher great opportunities to develop her existing skills, acquire new skills in the area of materials, environmental science and nanotechnology and, more specifically, in the area of technologies for remediation and clean-up devices, generate new knowledge and obtain training in transferable skills and thus develop a successful career as an independent researcher in the field of environmental science and materials for remediation.

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**NBR: 220280** **ACRONYM: NANOCAL** **EC FUND: 162509**

**DG:** REA **Call: FP7-PEOPLE-2007-2-1-IEF** **Thema:** PEOPLE-2007-2-1.IEF

**Title:** Magnetic mechanisms at the nanoscale studied by themal probe: nanocaloriometry and heat released.

**Abstract:** The continuous reduction of particle size in materials science has opened up new possibilities of producing materials at small length scales. The potential applications derived from the new properties of these materials span along multiple disciplines. In particular, magnetism at the nanoscale is the basis for new spintronic physics and devices. Whereas the production of nanoparticles, nanoclusters or multilayers of magnetic materials is widely spread, the understanding of phase transitions, specifically magnetic interactions (exchange bias, exchange spring) or magnetization reversal at the nanoscale remain a scientific challenge. In this project we propose to study nanomagnetic materials through their thermal properties or signatures in order to extract specific properties which cannot be deduced from regular magnetic characterization (magnetization, susceptibility measurement) more commonly encountered in the magnetism community. Calorimetry is an important tool to obtain information about magnetic phase transitions in bulk materials. Recently, highly sensitive sensors have been developed allowing measurements with a high resolution on ng samples. The development of suitable thermal sensor relies on a common principle, the use of a suspended membrane to isolate the core of the device from the heat sink. At low temperatures the calorimetric method giving the best results in terms of sensitivity is ac calorimetry. The group of Bourgeois has recently reach unprecedented sensitivities in the attojoule range. In the present project we will take benefit of this achievement to study the thermodynamic signatures in magnetic nanoparticles and in bilayer coupled films through magnetic exchange. The present approach will provide new insights in the understanding of the appearance of phase transitions at the nanometer scale (not yet understood) or in the magnetization reversal mechanism in exchange bias bilayer: the two major goals of our project.

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**NBR: 220292** **ACRONYM: QDS** **EC FUND: 225998**

**DG:** REA **Call: FP7-PEOPLE-2007-4-1-IOF** **Thema:** PEOPLE-2007-4-1.IOF

**Title:** New strategies for bioconjugation to quantum dots. Study of protein-nucleic acids and protein-protein interactions using fluorescence resonance energy transfer through quantum-dot-protein conjugates

**Abstract:** Quantum Dots (QDs) are a relative new semiconductor nanoparticles made from Cd/Se or Cd/Te with a shell of ZnS that have very excellent spectroscopic properties: broad absorption spectra, low photobleaching levels, narrow and symmetric emission bands, high quantum yields and large stoke shifts, which make them very attractive for fluorescence applications and, principally, for research studies in the biomedical field. The use of nanoparticles in vitro and in vivo has come in parallel with the development of water soluble QDs. However, together with the improvement in the solubility properties, there is a nascent necessity of developing efficient chemoselective methods of bioconjugation. This purpose is where is addressed this proposal to. We are going to try to use chemoselective ligations to attach peptides and proteins to QDs. In principle,

we are interested in oxime, hydrazone reactions and [3+2] azide-alkyne cycloadditions, because it´s known that are very selective and happen with efficient rates at low µM concentrations (~10 µM) forming thermodynamically and kinetically stable products. Moreover, these ligation reactions have been used with success in peptide-peptide and peptide-dye conjugations. Once we have developed the conjugation methodology, we have in mind to apply it to the study of protein-nucleic acids and protein-protein interactions through the well-known FRET technique (Fluorescence Resonance Energy Transfer). We think that attaching a low number of proteins per quantum dot (around 5-10 protein molecules/QD) we can get high amplifications in the FRET signal, which will allow us to measure thermodynamic parameters like binding constants. To evaluate the method, we´ll study the system formed by GCN4 (a natural Transcription Factor) and its CRE recognition site (5´-…ATGACGTCAT…-3´), principally because there is a high literature data that help us to validate the approach.

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**NBR: 220335** **ACRONYM: QUANTUM MODELLING** **EC FUND: 207317**

**DG:** REA **Call: FP7-PEOPLE-2007-2-1-IEF** **Thema:** PEOPLE-2007-2-1.IEF

**Title:** New computational tools for the modelling of correlations in quantum systems.

**Abstract:** The aim of this project is to use insights from exactly solvable models in order to improve the accuracy of quantum Monte Carlo methods for the modelling of correlated quantum systems such as ultracold atomic gases, nuclear matter and non-conventional superconductors. This will lead to a more precise understanding of the quantum correlations that exist in such systems and will allow to extend these insights to nuclear matter, neutron-rich atomic nuclei or neutron stars. The project also aims to clarify the relation between these systems and recent experiments on ultracold atomic gases. Through the development of new numerical simulation techniques the project will have considerable impact on the fields of nanotechnology (high-Tc superconductors, carbon nanotubes), quantum computing, nuclear waste transmutation and nuclear energy production.

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**NBR: 220419** **ACRONYM: MATERIALS NANOMECH** **EC FUND: 203052**

**DG:** REA **Call: FP7-PEOPLE-2007-4-2-IIF** **Thema:** PEOPLE-2007-4-2.IIF

**Title:** Nanomechanics of defects in solids: applications to nanolayers, nanoparticles, nanocrystals and biomaterials

**Abstract:** The central aim of the proposed project is to develop a general nanomechanics of defects framework for the understanding and prediction of structure-properties

relationships of nanoscale materials, components, and devices. This framework will be suitable for metal nanoparticles and nanorods, nanolayered films and core/shell nanowires, ultrafine grained bulk nanostructures, as well as carbon nanotubes and protein membrane nanotubes. While standard continuum mechanics and dislocation theory have been useful tools for addressing scientific and technological problems at macro and meso scales, their direct use is not suitable for nanoscale problems. Molecular dynamics simulations and their variants is a commonly used approach but also prohibitively expensive for realistic applications due to current computational limitations. The proposed project serves as a compromising alternative by developing a new methodology for understanding the evolution and stability of structural defects at nanosized volumes and advancing new continuum nanoelasticity and nanoplasticity models for capturing the deformation and fracture behavior of nanosized objects, devices and components. The results will be applicable to a variety of nanoscience and nanotechnology areas, including micro/nano opto-electronics, micro/nano electromechanical systems, bulk nanostructured metal processing and forming, as well as the structural stability of proteins in nanomembrane and nanotubular configurations. These results will be part of a book already in progress, and they will also be compiled as Lecture Notes in an existing Nanosciences and Nanotechnologies Curriculum in the host institution. The various workpackages of the project will also be among the topics of two planned international conferences-summer schools.

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**NBR: 220423** **ACRONYM: MIND** **EC FUND: 243268**

**DG:** REA **Call: FP7-PEOPLE-2007-4-2-IIF** **Thema:** PEOPLE-2007-4-2.IIF

**Title:** Investigation of electron induced chemical control using momentum imaging of negative ions from dissociative electron attachment

**Abstract:** This proposal aims at investigating chemical control using electrons by studying the dynamics of the dissociative electron attachment in gas phase molecules of practical interest using ion momentum imaging. These experiments will be complemented by measurements on molecules condensed on surfaces using electron beam irradiation as well as scanning tunneling microscopes. The proposal is motivated by the recent observations by several groups on molecules in gas and condensed phases that dissociative attachment allows control of electron induced processes. In particular, the group led by the applicant showed that functional group dependence exists in dissociative attachment allowing site/bond selective fragmentation of organic molecules using electron energy as a control parameter. They further investigated the dynamics of this process in selected small molecules using a novel technique developed by them for ion momentum imaging in low energy electron collisions. This technique allows characterization of the intermediate resonant state, the fragmentation pattern and the energy partitioning in the product channels. It is proposed to set up a similar experiment for ion momentum imaging arising from dissociative attachment and polar dissociation

in molecules relevant to nanolithography, astrochemsitry and radiation biology at the host institution. These experiments will be complemented by experiments on molecules condensed on surfaces by electron beam irradiation and by using scanning tunneling microscopes with a view to correlate the energy partitioning in the dissociative attachment process and the reactivity of the products. While the applicant brings in expertise on gas phase measurements like absolute partial cross section measurement and ion momentum imaging, the host group and his collaborators provide necessary expertise and facilities for complementary experiments in condensed phase and on surfaces.

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**NBR: 220443** **ACRONYM: TRANSCARB** **EC FUND: 178307**

**DG:** REA **Call: FP7-PEOPLE-2007-2-1-IEF** **Thema:** PEOPLE-2007-2-1.IEF

**Title:** TRANSITION METALS IN CARBON NANOSTRUCTURES

**Abstract:** This is a research proposal of Dr Maria Gimenez for a Marie Curie Fellowship in the Carbon Nanomaterials group, University of Nottingham. Maria is a talented young inorganic chemist coming from a leading university in Spain, and who has a strong expertise in molecular magnetism, which will be invaluable for this research programme. During her stay in the Dr Khlobystov's group she will learn unique experimental skills and methodology, which she will be able to transfer back to Spain. In this proposal transition metals chemistry will be applied for controlled assembly of fullerene dimers and magnetic quasi-1D chains inside carbon nanotubes, materials intended for nano-electronics and quantum information processing (QIP) applications. For example, individual endohedral fullerenes (such as N@C60) possess unique magnetic properties highly suitable for QIP applications. However, the assembly of multi-qubit systems by conventional methods of synthetic chemistry has proved to be extremely challenging. In this project we address this problem by applying the versatile and controllable chemistry of transition metals to fullerenes and nanotubes. The role of transition metals is twofold: (1) the metal centres are expected to provide efficient communication between electron spins in fullerene dimer architectures (two-qubit systems), and (2) the magnetic metal clusters are expected to serve as effective probes for the internal cavities of carbon nanotubes which can help to establish the mechanisms of the nanotube-electron spin interactions. The bonding of metal centres to carbon nanostructures is less disruptive than traditionally used covalent bonding. Therefore, transition metals are expected to have no detrimental effects on the intrinsic properties of fullerenes or nanotubes, but are anticipated to enhance the functional properties of these materials and to unlock their full potential for practical applications in electronic devices.

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**NBR: 220465** **ACRONYM: NANOSYM** **EC FUND: 160658**

**DG:** REA **Call: FP7-PEOPLE-2007-2-1-IEF** **Thema:** PEOPLE-2007-2-1.IEF

**Title:** Simulation of directed self-assembly of nanocrystals.

**Abstract:** The aim of the proposed research is to use novel Monte Carlo simulation techniques in order to gain insight into the factors that control the nucleation and growth of crystals of charged nano-colloids. Recent experiments (Shevchenko et al, Nature 439, 55(2006)) have shown that it is possible to grow a wealth of different crystal structures from binary mixtures of charged nano-colloids. However, the factors that determine which crystals will grow and which ones will remain microscopic in size are, at present, not understood. It is clear that both the charge and the size ratio of the nano-colloids plays a role. We aim to use a combination of different simulation techniques to predict the stability and nucleation barrier of such nano-colloidal crystals. Understanding these factors is important because nano-particle crystals can find applications in nanoelectronics, plasmonics, high-density data storage, catalysis, and biomedical materials. In our study, we will developed suitable models for the interaction between the nano-colloids. Subsequently, we will use a combination of various computational schemes (umbrella sampling, parallel tempering, forward flux sampling), to compute the barrier that determines the rate of crystal nucleation and the free energy of possible (meta)stable intermediates.

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**NBR: 220492** **ACRONYM: NANO-CHAPP** **EC FUND: 236211**

**DG:** REA **Call: FP7-PEOPLE-2007-4-1-IOF** **Thema:** PEOPLE-2007-4-1.IOF

**Title:** Track-etched Single Nanopores: Advanced Characterisation and New Applications

**Abstract:** This fellowship aims to develop the career of the researcher to the point where he is in a very strong position to start his own research group and secure funding to do so. This will be achieved by complementing his existing scientific knowledge to give him a broad and well rounded-expertise on nanopore fabrication, characterisation and applications, giving him training in complementary skills such as proposal writing, teaching and management, allowing him to build collaborations and making him well-known throughout his research field through publications, collaboration and conference attendance. A second aim of the fellowship is to transfer back to the European Union the leading scientific expertise on characterisation, modelling and application of track-etched nanopores only available at the Siwy Research Group at the University of California Irvine, USA, and to build long term collaborative links from this group and institution to the return host, the Photodetection and Imaging Research Group at University College Cork, Ireland. The scientific research and training objectives for this fellowship focus on single nanopores of diameters 2–50 nm, which are currently being explored for a wide range of applications, from single-molecule DNA analysis to biotoxin

sensing to creating ionic equivalents of electronic diodes and transistors. The specific objectives are a) to advance existing knowledge on track-etched nanopores by methodically characterising track-etched nanopore properties—essential for the commercial production of these nanopores that will soon be demanded as applications develop to the practical stage, b) to construct the first ever ionic circuits, based on the ionic diodes and transistors in development at the Siwy Research Group, and c) to develop an ionic diode based specific-sequence single molecule DNA sensor capable of detecting single DNA molecules with a specific sequence, at a rate much faster than competing techniques.

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**NBR: 220498** **ACRONYM: 4FNANOMAG** **EC FUND: 154821**

**DG:** REA **Call: FP7-PEOPLE-2007-2-1-IEF** **Thema:** PEOPLE-2007-2-1.IEF

**Title:** Theoretical basis for the design of Lanthanide-based molecular nanomagnets

**Abstract:** The design of molecular nanoscale magnets is a hot topic research area due to their technological interest in high density data storage or quantum computing. In this field, lanthanide-containing systems are appealing due to the large magnetic moment and large anisotropy associated with most of the lanthanides, key factors determining the temperature below which single-molecule(SMMs) and single-chain magnets(SCMs) retain the magnetization due to its slow relaxation. Whereas 3d-based molecular nanomagnets have been largely studied and their relaxation mechanisms are well understood, little is known for their novel 4f-based counterparts. For this reason, the aim of this project is to fulfill this lack of knowledge in order to support a future rational design of 4f-based nanomagnets for technological applications. For that, several theoretical methods will be employed: Quantum Chemistry methods for computing the Stark sublevels of the lanthanide ions, theoretical models for describing the dynamics of the magnetization in 4f-based nanomagnets and statistical physic methods for modeling the behaviour of the 4f-based SCMs. Moreover, X-ray, spectroscopic and magnetic measurements will be needed in order to provide suitable experimental data for developing and testing the theoretical studies. Due to the profile of the project, LAMM laboratory, one of the world leader laboratories in molecular magnetism, is the ideal place for its accomplishment because the large experience in molecular synthesis, including lanthanide chemistry, and the expertise in combining theory and experiment in the study of molecular-based magnets, in particular in SMMs and SCMs. Finally, the realization of the project will complement the theoretical and experimental expertise of the applicant in order to develop an independent career in theoretical aspects of molecular magnetism and it will afford him to establish contacts with other European research groups for future collaborations.

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**NBR: 220505** **ACRONYM: AIRMINWATSFG** **EC FUND: 167697**

**DG:** REA **Call: FP7-PEOPLE-2007-4-2-IIF** **Thema:** PEOPLE-2007-4-2.IIF

**Title:** Structure and Ultrafast Dynamics of Water and the Hydronium Ion at the Air/Water and Mineral/Water Interfaces using Time Resolved 2D-Vibrational Sum Frequency Spectroscopy

**Abstract:** Molecular level descriptions of the structure and dynamics of water and the hydronium ion are essential to understand quantitatively the dispersion of contaminants in groundwater, the role of aqueous aerosols in atmospheric chemistry and the optimal design of biomaterials. The structure of water and the stabilization of the hydronium ion at interfaces is a function of a hydrogen bond network. Each hydrogen bond in the network breaks and reforms on picosecond timescales. Current work describes structure in these systems by measuring the interfacial water and hydronium OH stretch frequency range using vibrational sum frequency spectroscopy (VSFS). Generally VSFS is time averaged: each data point in a spectrum involves several seconds of data collection. This approach necessitates loss of molecular information (in reality water structure evolves on picosecond timescales) and makes comparison to simulation, where trajectories have a maximum length of tens of nanoseconds, challenging. The proposed experiments overcome this obstacle by examining the air/water and mineral/water systems using femtosecond time resolved two-dimensional VSFS (tr2D-VSFS). This method allows the quantification of hydrogen bond (as a function of frequency) and hydronium lifetime in interfacial water. The measurement of these quantities at a variety of interfaces will allow general insight into the structure of aqueous complexes at interfaces, directly connect with simulation and help supply an experimental molecular level picture of the air/water and mineral/water intefaces that has been lacking. tr2D-VSFS is a specialized technique (employed currently by 1-2 research groups in the world). The impact of this proposal rests on the combination of an Earth Scientist with a peculiar background (nonlinear optics and computational chemistry), a host research group at the forefront of chemical physics and a host institute well prepared to support such a multidisciplinary collaboration.

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**NBR: 220507** **ACRONYM: NANO-PHOTOMED** **EC FUND: 83848**

**DG:** REA **Call: FP7-PEOPLE-2007-4-2-IIF** **Thema:** PEOPLE-2007-4-2.IIF

**Title:** Targeted Nano-Photomedicines for Multi-spectral Photodynamic Therapy of Cancer

**Abstract:** We propose to develop multifunctional, targeted nano-photomedicines that are capable of bypassing biological barriers to deliver nano-engineered photosensitizer drugs and molecular-imaging agents to tumor tissues and angiogenetic micro-vasculature.

Specifically, a unique nanomedicine system for targeted multi-spectral photodynamic therapy is proposed. The system consists of (i) luminescent quantumdot (QD) conjugated with photosensitizer (PS) drugs, which can be sensitized at its maximum efficiency using radiations of deep-tissue penetration (ii) molecular-imaging agents for the early stage detection and in situ treatment-effect analysis (iii) active targeting ligands to specifically target tumor and micro-vasculature. During the incoming phase, QDs of ZnS, Y2O3 and Gd2O3 emitting multi-spectral light under excitation with deep high-tissue penetrating radiations will be conjugated with PS so as to sensitize them at their characteristic absorption using Fluorescent Resonant Energy Transfer (FRET). The QD-PS will be combined with MRI contrast agents using `core/shell' nanotechnology and made water soluble by capping with polyethylene glycol (PEG). Finally, the nanomedicine will be connected with tumor specific ligands such as folic acid, MAbs and peptides. Optimization of nanomedicine will be carried out by studying dark and photo-toxicity in normal and cancer cell-lines in vitro. Photodynamic treatment will be carried out in pre-clinical animal models using multispectral radiations under different photo- and drug-dose conditions, followed by molecular imaging (MRI) based estimation of PDT response-dose inter-relationships. During the return phase, scanning probe imaging based investigations on the mechanism-of-activity of nano-photomedicines at intra-cellular regions leading to cell-death (apoptosis) will be investigated.

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**NBR: 220545** **ACRONYM: MESO-IMPLANT** **EC FUND: 168823**

**DG:** REA **Call: FP7-PEOPLE-2007-2-1-IEF** **Thema:** PEOPLE-2007-2-1.IEF

**Title:** Nanostructured Mesoporous Coatings of Implant Materials for Improved Bone Formation

**Abstract:** The MESO-IMPLANT project was inspired by the most recent achievements in nanotechnology and regenerative medicine and has two major objectives. The first one is based on the original idea of using the thin films of ordered mesoporous materials as coatings for bone implants. Such coatings have extremely high specific surface areas and pore volumes and are aimed to significantly improve the speed of bone formation on their surface. This would allow to lower the implant fixation time and to lower the probability of implant failure. The applicant will synthesize ordered mesoporous thin films of various metal oxides (eg. titania, alumina) and test how they can improve bone formation. The latter will be performed by direct contact of such layers with bone forming cells (osteoblasts) and observation of their bone forming activity (eg. under optical microscope). Additionally, the mesopore system will be functionalized with bioactive molecules which can mediate osteoblast adhesion process as well as to control the differentiation of the adult stem cells. Successful results of this project may open new research areas both in academia and in industry. The second aim of this project is to give the high-end interdisciplinary training-through-research in nanobiotechnology and nanomedice to the applicant. His background is chemistry and nanomaterials and

through this project he will have an unrivalled opportunity to develop his skills in bionanotechnology with help of the leading scientists in the filed. Moreover, he will have a chance to work in the highly multidisciplinary environment at one of the top universities in the world.

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**NBR: 220579** **ACRONYM: CO OXIDATION** **EC FUND: 210567**

**DG:** REA **Call: FP7-PEOPLE-2007-4-1-IOF** **Thema:** PEOPLE-2007-4-1.IOF

**Title:** A multiscale theoretical investigation of carbon monoxide oxidation on gold nanomaterials for energy and environmental applications

**Abstract:** A multiscale theoretical investigation of the CO oxidation on Au nanostructures supported on various oxides is proposed. Since Haruta's 1987 discovery of the exceptional activity of gold (Au) nanoparticles (2-5 nm in diameter), many groups have verified this exceptional activity towards many reactions when supported on certain oxides. For example, the Au/TiO2 system exhibits unprecedented activity in low temperature CO oxidation via O2. CO oxidation is of paramount importance not only in automotive catalysis but also in modern energy related applications including hydrogen production via the water-gas shift reaction with steam from fossil and renewable fuels, hydrogen purification via selective oxidation of hydrogen with oxygen, fuel cells, etc. Although the high activity of Au is beyond any doubt, there is still much debate on the nature of active sites and the underlying reaction mechanisms. Herein, a multiscale bottom-up approach will be developed that cuts among "ab-initio" and semi-empirical (free-energy related) techniques and integrates this information into first-principles Monte Carlo kinetics simulations in order to explain the exceptional reactivity of Au nanoparticles on certain supports, explore its electronic properties and eventually pave the way for design of efficient catalysts for hydrogen purification and fuel cells applications.

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**NBR: 220668** **ACRONYM: MRNA LOCALIZATION** **EC FUND: 169957**

**DG:** REA **Call: FP7-PEOPLE-2007-4-2-IIF** **Thema:** PEOPLE-2007-4-2.IIF

**Title:** Resolving the molecular mechanisms responsible for the localization of mRNA through active transport

**Abstract:** I intend to further characterize the molecular mechanisms responsible for the localization of mRNA (RNA) through active transport by motors on microtubule tracks. My specific aims are: 1) Elucidating the dynamics of active RNA transport. I will investigate how unique RNAs arrive at discrete cellular destinations using the same

molecular motor and the hypothesis that RNAs travel on distinct populations of microtubules. To study bicoid and gurken RNA transport particles I will use OMX for very rapid and highly sensitive image acquisition in three dimensions of several channels simultaneously. 2) Distinguishing the mechanisms of RNA maintenance and anchoring. I will test the hypothesis that the ultrastructure and composition of RNA transport and anchoring complexes changes through the course of development using cryo-immuo EM. I will compare the transport particles of different RNAs (i.e. bicoid, gurken, nanos) and co-visualize these with key transacting factors such as Stuafen, Exuperentia and Squid. 3) Determining the mechanism of multiple localization events for a single RNA. I will address the hypothesis that the confirmation and composition of transport and anchoring complexes stage at different steps and times during development. Using live cell imaging of photoactivatable components, I will characterize changes in residency time of RNAs and their transacting factors within transport and anchoring structures

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**NBR: 220682** **ACRONYM: ACRES** **EC FUND: 258341**

**DG:** REA **Call: FP7-PEOPLE-2007-4-1-IOF** **Thema:** PEOPLE-2007-4-1.IOF

**Title:** Array of coupled nanoresonators

**Abstract:** A novel system based on NEMS resonators will be developed. An array of coupled nanoresonators with a transduction based in the strain of thin layers of metal will be developed. To do that, analytical studies, FEM simulations, design and fabrication will be performed. The characterization will be done in three steps: measure frequency response of the system and characterization of the mass sensitivity (outgoing phase) and its use as a biosensor (return phase).

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**NBR: 220711** **ACRONYM: NOSOE** **EC FUND: 179690**

**DG:** REA **Call: FP7-PEOPLE-2007-4-2-IIF** **Thema:** PEOPLE-2007-4-2.IIF

**Title:** Nanocrystalline oxides for selective oxidative electrocatalysis

**Abstract:** The proposed project aims at understanding of the electrocatalytic activity and selectivity of the nanoctrystalline oxide electrodes in oxidation processes. Nanocrystalline forms of electrocatalytically active oxides based on pure RuO2 and Co3O4 and on the oxides derived from those by hetero-static substitution will be synthesized by advanced solution based techniques to obtain single phase materials with defined particle size and shape. Prepared materials will be characterized by diffraction techniques, X-ray absorption spectroscopies (EXAFS/XANES) and electron microscopy (SEM/HRTEM) to obtain information about the structure and surface

orientation. The electrocatalytic activity of the prepared materials with respect to industrially important electrocatalytic processes – chlorine and oxygen evolution will be characterized using and common electrocatalytic techniques (CV, DEMS, impedance spectroscopy). The active sites (or their model structural elements) for these processes will be identified by combination of ex-situ XPS and in-situ X-ray absorption spectroscopy (EXAFS/XANES). The obtained data will be used to formulate general relationships between the oxide surface structure and composition and its electrocatalytic activity and selectivity. These general rules may be in the long run used for rational design of novel electrocatalysts with tailored properties.

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**NBR: 220775** **ACRONYM: NIRNANOBIOSENS** **EC FUND: 158694**

**DG:** REA **Call: FP7-PEOPLE-2007-2-1-IEF** **Thema:** PEOPLE-2007-2-1.IEF

**Title:** Developement of robust and quantitative biosensors based on near-infrared two-dyed silicate nanoparticles

**Abstract:** The aim of this project is to develop quantitative biological sensors based on fluorescent spherical silicate nanoparticles (amorphous silica, zeolite beta) in controlled sizes in the range of 50 to 200 nanometers in diameter. The quantification of the analyte is based on a ratiometric detection of fluorescence from two dyes. The dyes are chosen such that the fluorescence of one dye is a function of an analyte (ion, biomolecule) concentration (sensing dye) whereas the fluorescence of the other dye is independent of variations in the medium (reference dye). Both dyes have the near-infrared light absorption property which lead to significant improvements for the detection in biological samples. The first step consists in confining a dye in the inorganic network yielding highly brilliant and photostable objects. Thus this fluorescent hybrid core can be used as the reference dye. Afterwards the ability of such material to undergo further chemical modification through the surface silanol functions and the use of coupling agents allows the immobilization of the sensing dye (commercially available or developed in the host structure). This is considered through various strategies e.g. direct immobilization or embedded polymeric shell.

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**NBR: 220928** **ACRONYM: NANOSENS** **EC FUND: 151936**

**DG:** REA **Call: FP7-PEOPLE-2007-2-1-IEF** **Thema:** PEOPLE-2007-2-1.IEF

**Title:** Nano-particles: their application in the development of electrochemical molecular beacon biosensors.

**Abstract:** Affinity biosensors, due to their selectivity, sensitivity and the fact they can be developed in a reagent-less and reusable format, find large application in environmental and clinical analysis. Key elements in biosensor development are: (i) the electrode surface (transducer) chemistry/properties, (ii) the recognition element and (iii) the signal generation element. In this proposal electrodeposition of nano-particles will be investigated as a way of modifying the transducer (electrode) chemistry/properties in order to improve/optimise the performances/layout of electrochemical molecular beacon biosensor. Several applications of RnEs will be investigated. · RnEs as a possible route to improve biosensors sensitivity (due the intrinsic catalytic properties of the nano-particles) · RnEs as a way generating specific attachment sites suitable for the recognition element. · Nano-particles as physical masks (template) for patterning, at nano size level, self assembled monolayer (SAM) of thiolated molecules onto Au surface (definition free sites, suitable for the recognition element attachment, in an antifouling matrix). Furthermore the influences of nature of the redox centre over the performances of electrochemical molecular beacon will be investigated in this proposal. The knowledge generated will be applied to the realisation of electrochemical molecular beacon DNA sensors for the prenatal diagnosis of Cystic Fibrosis and Thalassemia two of the most common genetic diseases. These areas of application have been chosen because of the relevance of the two diseases and because of the necessity to simplify the pre natal diagnosis of them that currently is performed with invasive, costly and risky procedures such as amniocentesis and “chorionic villa sampling”.

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**NBR: 221091** **ACRONYM: NANOSMARTS** **EC FUND: 156993**

**DG:** REA **Call: FP7-PEOPLE-2007-4-2-IIF** **Thema:** PEOPLE-2007-4-2.IIF

**Title:** Smart nondimensional biosensors for detection of tumor cells and cytotoxic amyloids intermediates.

**Abstract:** This project integrates the development of (a) bioconjugated silicon nanoparticles (NPs) as new,< 3nm, fluorescent probes and (b) dual-emission band fluorescent biosensors for protein conformation investigations to be applied in diagnostic procedures related to tumor biology and neurodegenerative diseases. Epidermal growth factor receptor (EGFR) is an important therapeutic target in a variety of tumors, particularly malignant gliomas where mutation and/or amplification of EGFR is often observed. The laboratory has demonstrated in a pilot study the specific binding of biomolecules conjugated to Quantum Dots to patient-derived glioma spheroids. High wavelength emitting QDs are necessary to distinguish binding from tissue autofluorescence but such QDs are large (~40 nm) and do not penetrate deeply into tissues or access cellular junctions. The project will develop smaller, more inert, and less toxic conjugated silicon nanoparticles that can ultimately be used for the detection of residual glioma cells in patients after surgical resection. Additionally, more complex composite nanoparticles that selectively internalize in the tumor cells will be investigated as vehicles for drug delivery or

selective killing. The aggregation of proteins and peptides is a fundamental feature of neurodegenerative diseases such as Alzheimer's, Parkinson's and spongiform encephalopathies. It is not clear whether the fibrillar aggregates or smaller forms of the implicated proteins are the cause of cytotoxicity. Both in vitro assays and in vivo studies are hampered by the lack of probes that can distinguish and quantitate early stages of the aggregation phenomenon. This project will develop fluorescent biosensors for protein folding on the basis of environment sensitive ratiometric dyes that exhibit dual emission. Such dyes are prospective tools for a development of facile and rapid assays for protein folding for application in diagnostics and drug screening assays.

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**NBR: 221111** **ACRONYM: BIONANOSMART_DDS** **EC FUND: 216049**

**DG:** REA **Call: FP7-PEOPLE-2007-4-2-IIF** **Thema:** PEOPLE-2007-4-2.IIF

**Title:** Biopolymer-Based Nanoparticle â€œSmartâ€• Drug Delivery Systems and their Biopharmaceutical Application by Oral Administration

**Abstract:** This initiative aims to gain both fundamental understanding and applied knowledge on novel polysaccharide-based nanoparticles to be utilized as 'smart' advanced delivery systems of therapeutic biomacromolecules for oral administration. To this end, nanoparticles will be harnessed from chitosan and other polyionic polysaccharides of biomedical use, cross-linked with a natural non-toxic biocompatible agent. Sensitivity to changes in temperature and pH will be conferred by modifying the surface charge (zeta potential) by modifying the local hydrophilic/hydrophobic balance the nanoparticle surface. While sensitivity towards two biomolecules of therapeutic significance will be achieved by modifying the nanoparticle surface by molecular imprinting, using a non-covalent approach. Phase transitions in these systems will be investigated by means of biophysical techniques including dynamic light scattering and SAXS (small-angle X-ray scattering). The adsorption capacity and selectivity of the molecularly imprinted surface will be studied by quartz crystal micro balance with dissipation mode (QCM-D) techniques. The in vitro release profile will be evaluated as a function of the presence of the external stimuli (temperature, pH and concentration of specific molecules). Citotoxicity and cell uptake will be evaluated in Caco-2 cell monoculture and the biopharmaceutical performance will be evaluated for selected prototypes after oral administration in a rat model.the biopharmaceutical performance will be evaluated after oral administration in a rat model.

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**NBR: 221143** **ACRONYM: LEAP TOMOGRAPHY** **EC FUND: 242235**

**DG:** REA **Call: FP7-PEOPLE-2007-4-1-IOF** **Thema:** PEOPLE-2007-4-1.IOF

**Title:** Exploring the three-dimensional nanoscale space around defects in Ni-based superalloys for aircraft applications employing atom-probe tomography

**Abstract:** The research proposed is part of an extensive work aimed at investigating the formation of defects during the solidification of Nickel-based superalloys, where the goal is establishing criteria that enable avoiding their formation. We intend to employ the latest version of the Atom-Probe Tomograph, namely the Local-Electrode Atom-Probe (LEAP), which is the best analytical experimental tool available today for characterizing the chemistry of solid materials in the sub-nanometric scale. The results obtained by LEAP will be used as input data for ab-initio Molecular Dynamics (AIMD) simulations and compared with nano-mechanical testings. The approach of combining both LEAP tomography results with mechanical behavior in the nano-scale, as well as implementing AIMD, may serve as a very powerful tool in the understanding of materials science fundamentals, e.g. the correlation between mechanical properties, composition, and morphology. Specialization in the most powerful atomistic-tomography tool known today, the LEAP, is essential for preserving the high level of scientific research in Israel, thus encouraging further scientific collaboration between Israel and other EU countries as well as the USA. We intend to perform the LEAP characterization work as well as the analytical modeling at the Northwestern University Center for Atom-probe Tomography (NUCAPT) leaded by Prof. David Seidman. The rest of the research work including Transmission Electron Microscopy (TEM) as well as computer-aided simulations will be performed in the return stage at the Technion, Faculty of Materials Engineering, and leaded by Prof. Wayne Kaplan.

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**NBR: 221173** **ACRONYM: MMMPMI** **EC FUND: 206454**

**DG:** REA **Call: FP7-PEOPLE-2007-4-2-IIF** **Thema:** PEOPLE-2007-4-2.IIF

**Title:** Multiscale Modeling of Mechanical Properties of Metals and Interfaces

**Abstract:** This main objective for the Marie Curie International Incoming Fellowship is to expand and strengthen the research/educational activities of the Mechanics Laboratory at the Aristotelion University of Thessaloniki, (AUT), Greece, by forming a formal and long-term collaborative relationship with the W. M. Keck Computational Materials Theory Center (CMTC) at California State University Northridge (CSUN), an NSF-funded Center. We propose to develop physical models, numerical algorithms and robust multiscale simulation techniques to study and predict the mechanical properties of metals and nanolaminates. Key features of the modeling efforts will include studies of dislocation cross slip, kink nucleation, interfaces, and chemistry on mechanical properties in metals and interfaces, which are potential candidates for structural applications at elevated temperatures. These developments involve linking multiple length and time scales, as well as combining various building blocks that have been studied in the traditionally separated disciplines. These disciplinary boundaries need to be eliminated in order to

seamlessly integrate complementary computational methodologies and thereby facilitate the investigation of problems too complex to be tackled by a single technique. To accomplish these goals, we have assembled a multidisciplinary team consisting of a tightly knit group of scientists with coordinated and complementary skills and with extensive expertise in this area. Both faculty members have developed at least one major large-scale computational approach; the extensive and diverse experience in computational materials science of the group makes for a highly efficient team, capable of innovative developments in computational materials design. The CSUN-ATU partnership will significantly advance the quality of research/education at ATU to achieve national competitiveness and promote accessibility of frontier research/education experience in multiscale modeling to students.

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**NBR: 221198** **ACRONYM: RBCE-GENODIAGNOSENS** **EC FUND: 159166**

**DG:** REA **Call: FP7-PEOPLE-2007-2-1-IEF** **Thema:** PEOPLE-2007-2-1.IEF

**Title:** Recuring breast cancer early genetic diagnostic on a chip

**Abstract:** The overall objective of RBCE-GenoDiagnoSens is to exploit breakthroughs at the confluences of micro-, nano- and bio-technologies to initiate the creation of a low-cost minimally-invasive intelligent diagnosis system using a nanotechnology-based device for the early detection of DNA biomarkers involved in breast cancer, especially found in circulating tumour cells (CTCs). The device will consist of an array of nano-biosensors for the consecutive RNA/DNA analysis of cancer cells. The advantages of the exploited biosensors for RNA/DNA analysis are their sensitivity, their inherent selectivity, their versatility and their cost effectiveness. Death from cancer is usually due to metastases that are formed by hematogenic or lymphatogenic spread of cancer cells from the primary disease site. Fortunately, only a subset of these persist and have the ability to form vascularised macro metastases. Therefore, the quantification and characterisation of circulating tumour cell mRNAs in order to define the metastatic potential is of clinical relevance and may prove valuable for monitoring disease progression and patients response to treatment, and assessing the risk for metastasis or recurrence. With prognostic implications, the quantities of mRNA markers in blood could indicate the stage of cancer progression and the need for more intensive therapeutic intervention to better the outcome of cancer patients. In the frame of the RBCE-GenoDiagnoSens, the leading research scientist will design, taylor and test the optimum surface chemistry for the functionalisation and operation of the nano-biosensors, following his established expertise in the field, while the host institution will provide the complementary knowledge and training in microfabrication, DNA expertise, mass-manufacturing, regulations and commercialisation consideration as routes for the researcher to establish his own autonomy and his progression to become a successful principal investigator within the European Union

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**NBR: 221230** **ACRONYM: ACTOSPED** **EC FUND: 200423**

**DG:** REA **Call: FP7-PEOPLE-2007-4-1-IOF** **Thema:** PEOPLE-2007-4-1.IOF

**Title:** Active Organic Surface Plasmon Enhanced Nanophotonic Devices

**Abstract:** In this project, surface plasmon enhancement of emission from discrete active organic 1-D photonic nanostructures will be investigated as a means to enhancing the performance and electrical integration potential of miniaturized organic emissive devices. To this end, nobel metal (e.g., silver or gold) nanoparticles (NPs) which can support surface plasmons will be brought into close proximity (5 - 20 nm) to a light emitting conjugated polymer nanowire. The distance between the nanoparticle and the nanowire will be controlled using a dielectric spacer layer. Rational techniques for optically exciting and detecting plasmon resonances and surface plasmon meditated luminescence in the polymer nanostructures will also be developed. Enhancement of radiative and non-radiative decay rates in the emissive conjugated polymer as a function of metal-emitter separation distance will be studied. In addition, the emission intensity enhancement factor will be studied as a function of dipole orientation (i.e., molecular alignment) within the polymer nanowire. In addition, finite-difference time domain (FDTD) simulations of the electric field intensity generated by plane wave illumination will be used to obtain maps of the radiative decay rate enhancement of an organic nanowire near a small metal nanoparticle. The project will draw on core expertise of the researcher in organic active nanowire photonic devices and combine this expertise with the vast experience of the host groups at Caltech and University Louis Pasteur – Strasbourg in passive and active plasmonic devices. The organic plasmon enhanced photonic devices are likely to exhibit comparable performance, be of lower cost and be simpler to manufacture than their inorganic counterparts.

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**NBR: 221233** **ACRONYM: MULTI-PGNAS** **EC FUND: 162096**

**DG:** REA **Call: FP7-PEOPLE-2007-2-1-IEF** **Thema:** PEOPLE-2007-4-3.IRG

**Title:** Multifunctional Photothermal Gold Nanoarrays for Cellular Manipulation

**Abstract:** Transporting, organizing, attaching, guiding, releasing entities of various dimensions over different scales remain central to the development of high throughput biological devices able to conduct millions of tests in a short period of time. The proposed project intends to develop a new generation of substrates for cell manipulation based on photothermal processes. Specifically, it focuses on realizing standard and new functions related to tissue engineering and cell transportation by designing a single type of

platform. This project aims to implement photothermal gold nanoparticle arrays (PGNAs) to physically manipulate various types of entities, like living cells. Each gold nanodot will play the role of an adhesive spot exposing the RGD peptide, which are separated by nonadhesive regions functionalized with poly(ethylene glycol) (PEG), so that cell-binding sites will exclusively interface the nanoparticle. By irradiating well-defined areas of the PGNAs with a focused laser beam, the fellow hopes to take advantage of the local heating generated by the nanoparticles to prevent cell attachment in these hot areas. This way, it is possible to study and integrate multiple functions in order to deliver one unique dynamic platform able to precisely control both cell adhesion (releasing, patterning, guiding) and cell transportation (via optofluidics) at the PGNA interface. The "Multi-PGNAs" project may permit to integrate the same nanotechnology for the development of modern applications, while providing innovative methodologies for designing new experiments in cell biology and nanophysics.

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**NBR: 221323** **ACRONYM: ORGANOMETALLICSWITCH** **EC FUND: 178163**

**DG:** REA **Call: FP7-PEOPLE-2007-2-1-IEF** **Thema:** PEOPLE-2007-2-1.IEF

**Title:** metal-carbene complexes for the synthesis of molecular switches and devices

**Abstract:** Considerable effort is currently being devoted to the miniaturization of electronic devices to the nanometer scale, ideally affording systems that operate on a molecular level. Chemist's contribution to this research area has thus far concentrated on the preparation of organic OR inorganic materials. For example, purely metallic GaAs and GaP nanowires have been constructed for semiconductor applications. While these materials show excellent electron mobility properties, their tuning potential is rather low. In contrast, organic semiconductors such as conjugated oligomers or polymers display promising properties, though their electron carrier properties are intrinsically lower than that of metallic materials. Organometallic species comprising tunable organic ligand moieties and transition metal centers featuring an enhanced electron mobility may combine the advantages of purely inorganic and organic materials and are therefore expected to be particularly useful as molecular units for the fabrication of new electronic devices. The proposed research aims at identifying molecular switches based on mono- and multimetallic complexes and at their implementation in electronically active devices, thus creating intelligent materials. While organometallic chemistry dominates the highly synthetic first part of the project, the characterization and application of self-assemblies in molecular electronics clearly requires an interdisciplinary approach.

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**NBR: 221404** **ACRONYM: MAJIC-SPIN** **EC FUND: 168823**

**DG:** REA **Call: FP7-PEOPLE-2007-2-1-IEF** **Thema:** PEOPLE-2007-2-1.IEF

**Title:** Doped Magnetic ZnO p-n Junction Heterostructures for Nano-Spintronic Devices

**Abstract:** Semiconductor materials form the basis of modern electronics, communication, data storage and computing technologies. One of today's major challenges for the development of future technologies is the realization of devices that control not only the electron charge, as in present electronics, but also its spin, setting the basis for future spintronics. Spintronics represents the concept of the synergetic and multifunctional use of charge and spin dynamics of electrons, aiming to go beyond the traditional dichotomy of semiconductor electronics and magnetic storage technology. The most direct method to induce spin-polarized electrons into a semiconductor is by introducing appropriate transition metal dopants producing a dilute magnetic semiconductor (DMS). The seamless integration of future spintronic architectures into nanodevices would require the fabrication 1-D DMS nanostructures in well defined architectures. In this project we propose to use a simple low-cost, low-temperature electrodeposition process to not only synthesise and characterise ZnO based bipolar DMS nanowire heterostructures but, even more importantly, fabricate an array of p-n and n-p-n junctions which could lead to novel nano-spintronic devices within ordered pre-defined nano-architectures. We will study the structural and functional properties of these heterostructures, which could have applications such as spin polarised LED and spin polarised bipolar junction transistor. By fully exploring the parameters controlling the growth and functionality of these materials we will try to gain a holistic understanding of the processing/structure/property relationships for this system. The ultimate goal of this project is to be able to design and fabricate specific nanowire heterostructures with tuneable magnetic and electrical properties which could lead to practical spintronic applications. Moreover this approach is inherently clean and scalable and easily integrated within current industrial practice.

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**NBR: 221482** **ACRONYM: SENSOMETAL** **EC FUND: 230963**

**DG:** REA **Call: FP7-PEOPLE-2007-4-1-IOF** **Thema:** PEOPLE-2007-4-1.IOF

**Title:** Nanosensors to monitor metal dynamics in living plant cells

**Abstract:** Metals, such as manganese or zinc, are vital elements for plant growth and development. They are involved in many biological processes and one third of characterized enzymes are metalloproteins. Because metal excess or metal deprivation is deleterious for cells, plants have developed mechanisms to regulate the uptake, the transport and the storage of metals. Dr Thomine's group, in Gif-sur-Yvette (France), has obtained evidence that metal compartmentalization is essential for metal homeostasis. However, no tools are currently available to monitor the dynamics of metal concentrations in living plants. Prof Frommer's group, in Stanford (USA), pioneered the

design of genetically encodable FRET nanosensors for living cells. The project will aim at developing a set of metal nanosensors to image in vivo the dynamics of manganese and zinc localization and their regulation in Arabidopsis thaliana. An integrated approach in plants, combining the use of mutants impaired in metal transport and metal imaging, will enable us to further understand biological processes underlying the control of metal homeostasis in plants. This project will enable the researcher to acquire new expertise in the design of nanosensors for living cells.

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**NBR: 221515** **ACRONYM: MOCNA** **EC FUND: 233164**

**DG:** REA **Call: FP7-PEOPLE-2007-2-1-IEF** **Thema:** PEOPLE-2007-2-1.IEF

**Title:** Magneto-optics of carbon nano-allotropes

**Abstract:** The project aims at magneto-optical spectroscopy studies of carbon nano-allotropes: graphene, individual nano-tubes and graphene nano-ribbons. The main objective of the project is to explore the new fundamental phenomena by studying the structures which are among the most promising ones for development of future nano-technologies. Understanding the properties of these systems will certainly have the impact on the effectiveness of their applications. The project consists of three specific parts. The first one focuses on investigations of electron-phonon interaction and collective modes of electronic inter Landau level excitations in graphene flakes, using the methods of magneto-Raman scattering. These interactions are one of the central points of graphene, seen as unconventional two-dimensional electronic system. The second part aims at deeper understanding of the exciton structure and its excited states in single wall carbon nanotubes. Ensembles of nanotubes and furthermore individual objects will be studied using various magneto-spectroscopy techniques. To this end, the measurements of single photon-correlation are planned in order to identify correlations between different excited states characteristic of the carbon nanotube. The third part of the project, of exploratory character, is focused on searching for the evidence of the reduced dimensionality in the spectroscopy of artificially obtained graphene nanoribbons. The new structures will be first characterized using the micro-Raman spectroscopy (basic phonon mode of graphene is expected to be modified by the reduced size of the stripe), and eventually studied using other magneto-spectroscopy methods. These experiments may be used to verify the theoretical predictions concerning the properties of these, very much demanded systems.

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**NBR: 221543** **ACRONYM: INNATE** **EC FUND: 246177**

**DG:** REA **Call: FP7-PEOPLE-2007-2-1-IEF** **Thema:** PEOPLE-2007-2-1.IEF

**Title:** Integrated Nanocrystal Tunnelling for Molecular Electronics

**Abstract:** The INNATE project focuses on noble metal nanocrystals in the quantum confinement size range as active elements in molecular electronic circuits. Supported by a successful proof-of-concept experiment, multistate switch and transistor function for these systems will be demonstrated, unparalleled in conventional electronics. This novel electronic function will be integrated with that of tailored redox molecules both in a vertical Scanning Probe Microscopy configuration and in a nanogap electrode set-up to form nanoelectronic circuits, thus bridging top-down and bottom-up approaches. Our strategy focuses on electrolyte gating at electrified solid/liquid interfaces, which can address physical gates down to 1 nm by achieving strong electronic coupling, and allows the target "device" to function under ambient conditions. In addition to its ambitious technical goals, the INNATE project will substantially contribute to prospects of professional maturity and independence of the applicant by adding crucial scientific competencies in the highly interdisciplinary area of nanoscale electrochemistry and molecular electronics, thus developing his research niche of organic–inorganic hybrid nanostructures towards a high-level molecular understanding of structure–functionality–reactivity relations. Research training objectives focus on advanced scanning probe and nanogap electrode techniques, together with complementary training in research management, high-level dissemination and networking activities, including links to industry. Fully integrated in the European Research Area, the project will significantly enhance visibility and attractiveness of European science and technology.

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**NBR: 221573** **ACRONYM: QUOM** **EC FUND: 166982**

**DG:** REA **Call: FP7-PEOPLE-2007-2-1-IEF** **Thema:** PEOPLE-2007-2-1.IEF

**Title:** Quantum Optomechanics using Monolithic Micro-Resonators

**Abstract:** Research groups working on mechanical systems ranging in size from nanometer-scale oscillators or centimeter-scale optical cavities to kilometer-scale gravity wave detectors are all independently approaching a regime, where the observation of quantum mechanical phenomena with mechanical objects might become observable. These results have been catalyzed by the recent development of a novel laser cooling technique which allows cooling mechanical oscillators coupled to an optical resonator. As a result researchers from backgrounds as diverse as astrophysical gravity waves, mesoscopic condensed matter physics, and quantum optics are converging on a common set of goals related to quantum effects in mechanical systems. These goals relate to the observation of a distinct set of phenoma, such as quantum-backaction, ground state cooling, entanglement and generation of non-classical states of motion which would hallmark the birth of a new research field, "quantum optomechanics". Within this scientific setting, the applicant will join the research group of Dr. T.J.

Kippenberg within the Division of Laser Spectroscopy of T.W. Haensch and seek to demonstrate quantum phenomena of mechanical objects in the form of toroidal monolithic microcavities. Within the tenure of the applicant it is expected to observe quantum mechanical phenomena relating to macroscopic mechanical objects. The training aspects of the project involve a significant enlargement of the scientific field of the applicant into a fast-advancing moving new area of opto-mechanics of micro-resonators, acquisition of cutting-edge micro-fabrication technical skills and the development of project management and apprentice guidance methods, essential for an independent research career. The hosting institution is the Max Planck Institute of Quantum Optics (MPQ), a world renowned center for quantum optics. The applicant is a French scientist, with Ph.D. training at the ENS, and seeking to expand his scientific knowledge.

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**NBR: 221660** **ACRONYM: NANOSICON** **EC FUND: 159828**

**DG:** REA **Call: FP7-PEOPLE-2007-4-2-IIF** **Thema:** PEOPLE-2007-4-2.IIF

**Title:** High-temperature stable nano-structured silicides for highly efficient thermogenerators and their contacting technology

**Abstract:** Deficiency of natural energy resources on Earth makes advanced energy management a challenge. Efforts are taken to harness cheap, inexhaustible, eco-friendly renewable sources of energy. Among these, thermoelectric (TE) conversion is a promising principle. Best materials for TE application are non-conventional heavily doped semiconductors. In particular, high temperature stable silicides (higher manganese silicides = HMS, CrSi2 and others) represent suitable candidates for demanded TE applications operable at high temperature. A main aim of TE materials development is to improve the figure of merit ZT, which essentially depends on the energy band structure and scattering of carriers and phonons in the material. It is planned to investigate qualitatively the transport behaviour of HMS compacted from nano-sized powders, to optimize its properties by chemical synthesis, and to reach a reduction of the thermal conductivity in nano-crystalline material. Starting from the synthesis of nano-powders by melting and ball milling, forming of a nano-structure with suitable scaling will be optimized by a rapid hot pressing technology. CrSi2 and other high temperature silicides will be optimized in a similar way for high electrical and thermal conductivity. They shall be applied as contacting materials and interlayers, ending up to advanced materials and technology procedures for high temperature thermogenerators. Materials will be characterized by XRD, SEAD (structure), TEM, SEM (morphology), EDAX (analysis). Having achieved the targeted nano-structure, the TE properties will be measured in dependence on temperature for optimising the application-relevant material parameters. The performance of thermogenerator devices based on the new solutions will be tested by unique measuring techniques of the host. The fellow will deepen his knowledge and

experience on TE materials and thermogenerator technology for high temperature and is expected to develop superior contacting methods.

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**NBR: 221701** **ACRONYM: CARBOTRONICS** **EC FUND: 234536**

**DG:** REA **Call: FP7-PEOPLE-2007-2-1-IEF** **Thema:** PEOPLE-2007-2-1.IEF

**Title:** Opto-electronic properties of graphene and other carbon nanostructures

**Abstract:** Project covers theortical/computational studies of optoelectronic properties of graphene and other carbon-based nanostructures, aimed at both fundamental effects and application in future graphene nanotechnology. Major goals are: (i) learning new, powerful methods of electronic-structure calculations (quantum Monte Carlo and density functional theory) and their application for graphene nanostructures; (ii) learning methods of field theory and combining them with extensive present expertise for the studies of many-body effects in electronic and optical response, with expected application in novel nanodevices; (iii) learning complementary skills for establishment of home interdisciplinary research group focused on nanoscience/nanotechnology of new structures/materials and integrated with big EU research programmes (leadership skills, acquiring funds, project management, work in collaboration); (iv) acquintance with (and import of) teaching methods/practices (excellence in this academic skill being crucial for Applicant's promotion to a full professor upon return). Project's success relies on Applicant's present potential/experience (mostly in fundamental research, but also in teaching and leadership) and on superb quality of the host (Cambridge in general, Cavendish Laboratory in particular) in all essential aspects (research, participation in European science, and teaching). The main results will be: (i) multi-aspectual individual education of the Applicant (at a rate possible only due to continuous interaction with Europe's best specialists and exposure to unparalleled academic environment) as well as (ii) enhancement of attractiveness and potential of European science by means of transfer of knowledge and research/academic habits from the leading European university to a major but still rapidly developing research/academic institution in Poland and (iii) efficient incorporation of the latter in priority EU research programmes.

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**NBR: 221742** **ACRONYM: GRAPHENETHIOPHENE** **EC FUND: 167697**

**DG:** REA **Call: FP7-PEOPLE-2007-4-2-IIF** **Thema:** PEOPLE-2007-4-2.IIF

**Title:** Novel kind of graphene based materials and its blend with polythiophenes

**Abstract:** Diamond and graphite, the two well-known allotropes of carbon, were familiar from the ancient times. Fullerenes, the third form of carbon, were discovered in 1985 and carbon

nanotubes in 1991. Thus three dimensional (3D) (diamond and graphite), 1D (nanotubes) and 0D (fullerenes) allotropes were known. Since the breakthrough in 2004 that two dimensional allotropes of carbon, graphene has been reported. It can be used in molecular electronics applications, such as field-effect transistors, research into this novel material has exploded. Graphene, a single sheet of graphite, consists of a hexagonal array of sp2-hybridised carbon atoms. The material has excellent electrical properties, is cheap to make and requires no helicity control, giving it a definitive advantage over other carbon-based materials such as nanotubes. In addition, the electronic properties of graphene sheets can be influenced by introducing atomic defects, using programmed self-assembly, and by changing the charge carrier concentration in bilayer graphene. Unfortunately though, the conductivity as of yet cannot be switched off, which impedes its incorporation into switchable systems. Recently, the poor material properties of the graphene were improved considerably by dispersing the single carbon sheets inside a polymer matrix, providing a path to a broad class of conductive composite graphene-based materials. The construction of small graphene sheets by chemical synthesis has recently been reported by Müllen. This bottom-up chemical synthesis of such large, unsaturated polycyclic aromatic hydrocarbon surfaces, however, has proven very laborious and time consuming, requiring a huge synthetic effort. Therefore, the aim of this proposal is the construction and physical characterisation of a novel class of materials which closely resemble graphene, by facile chemical synthesis, which can be synthetically tailored and post-processed to tune the material properties: clickgraphene.

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**NBR: 221811** **ACRONYM: POLYCONDNA** **EC FUND: 169957**

**DG:** REA **Call: FP7-PEOPLE-2007-2-1-IEF** **Thema:** PEOPLE-2007-2-1.IEF

**Title:** Synthesis, characterization and conductivity studies of conducting polymer-DNA hybrids

**Abstract:** In this project we propose to develop conducting nanoscale molecular wires based on hybrid polymer materials. The concept is to use DNA as a scaffold for the attachment of polymerisable monomer units covalently bound to the DNA nucleosides. Novel synthetic nucleosides will be prepared for oligomerisation using automated solid phase DNA synthesis. It is intended to synthesise modified nucleosides, in particular the pyrimidines, which can be applied to the sequence specific synthesis of DNA strands. The nucleoside will be modified with units derived from pyrrole and thiophene since these compounds are readily polymerized to conducting materials. In using DNA as a scaffold or backbone the self-assembling properties of DNA may be exploited for the construction of large and complex nanoscale architectures. In this way it should be possible to direct the assembly of nanoscale wiring by using the inherent biological assembly process of the DNA part of the hybrid material. Established synthetic methodologies will used for the synthesis of the precursor compounds and these will be characterised using standard techniques to establish structural details, e.g. NMR,

elemental analysis, ionized electrospray mass spectroscopy LC(IES-MS), spectroscopic (FTIR, UV-vis). The synthesis of DNA oligomers will rely on phosphoramidite chemistry and automated solid phase protocols. The formation of conducting polymer wires will involve oxidation of the resulting DNA-pyrrole/DNA-thiophene strands using chemical and electrochemical approaches. The resulting materials will be characterised using a range of spectroscopies (FTIR, CD, UV-vis) as well as voltammetry and probe microscopy. Finally, the conducting properties of the materials will be examined using a combination of 2-electrode devices and scanning probe methods.

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**NBR: 221980** **ACRONYM: NANOCHEMIMAGE** **EC FUND: 45000**

**DG:** REA **Call: FP7-PEOPLE-2007-2-2-ERG** **Thema:** PEOPLE-2007-2-2.ERG

**Title:** Nanoscale chemical imaging: Tools and techniques for localised infrared spectroscopy of nanostructured polymers and biomaterials.

**Abstract:** The science of nanoscale structures and processes is currently an area of enormous activity, attracting great cross-disciplinary interest from researchers worldwide. This rapidly developing field requires novel tools and techniques for nanoscale analysis. The atomic force microscope (AFM) and scanning near-field optical microscope (SNOM), for example, have developed in response to this requirement. Recent work has demonstrated the potential of SNOM techniques to enable nanoscale infrared (IR) spectroscopy. Such a capability would be of immense value in understanding chemical processes at the nanoscale, such as those driving the self-assembly of materials or modifying protein conformation. Progress towards true nanoscale IR spectroscopy is, however, badly hampered by the lack of suitable widely-tuneable IR laser sources. The proposed reintegration grant will provide valuable supplementary support to five-year fellowship project, recently awarded to the researcher. This project addresses the development of suitable tuneable sources, based on nonlinear optical frequency conversion techniques, and their application to IR SNOM for the first time, thus enabling effective spectroscopic analysis of nanoscale objects. Collaborative studies of nanostructured materials and biomaterials will both validate the techniques developed and address important issues in the study of these systems. It is anticipated that the final outcome of this project will be a novel analytical tool of great value to nanoscale research in chemistry, physics and the materials and life sciences.

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**NBR: 221989** **ACRONYM: FACOMP** **EC FUND: 954304**

**DG:** REA **Call: FP7-SME-2007-1** **Thema:** SME-1

**Title:** Polymeric nanocomposite profiles for curtain walls

**Abstract:** Curtain wall facade is being constituted in one of the most used at the present time due to its facility of construction, lightness and to the great variety of materials and finished textures that are possible to obtain. The curtain walls are constituted by two elements clearly differentiated: • The structural profiles of the curtain wall (the one in charge to support the glass or the coating panels and to join structurally the facade to the building) • And the coating material which is the one that provides the final finished one. Generally this finishing is glass although exists the possibility of using other materials if it's required to give an opaque finish to the end item. At the present time the materials more used for the structural profiles are aluminium and steel. These materials have a widely extended use although they often present/display problems of supply and recycling. Besides, it's thermal behaviour is not appropriate since they are materials of great thermal transmission. This project is intended to define a new system and a new nanomaterial to be used in substitution of the steel and aluminium for structural profiles. The system to develop must fulfil the same or better mechanical characteristics than the steel and aluminium, must be lighter, weather resistant and with better thermal and acoustic behaviour. The introduction of a new material will also imply a redesign or an adaptation of characteristics of the rest of materials that compose the curtain wall (joints, silicone adherence, glass, etc). The materials that will be used for the profiles are polymeric nanocomposites reinforced with fibres and nanoparticles. These materials exhibit several advantages comparing with those of the aluminium and steel: Mechanical properties: Lightness, Maintenance, Chemical behaviour, thermal properties, Design flexibility and Fire properties.

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**NBR: 222006** **ACRONYM: NANOFOODS** **EC FUND: 726000**

**DG:** REA **Call: FP7-SME-2007-1** **Thema:** SME-1

**Title:** Development of foods containing nanoencapsulated ingredient

**Abstract:** The preservation of bioactive food ingredients through product processing and storage, and their controlled release in the gastrointestinal tract is yet a major obstacle for the full exploitation of the health potential of many food bioactive components. In addition, conventional microencapsulation solutions often affect the textural sensory properties of the food. The overall objective of the NANOFOOD project is to develop and the validate the efficacy of a new generation of healthy foods based on nanocapsules technology. Tailored nanocapsules able to deliver omega-3 fatty acid and silymarin complex into the lower gut will be designed and produced by a specialized Israeli SME in collaboration with Technion, Haifa. These nanocapsules will be incorporated as bioactive ingredients into dry pasta by an Italian SME and into typical bread products by a Turkish SME. The development and characterization of these products will be supported by food scientists operating in leading research centres. Finally, the efficacy of the developed

food products will be assessed by a human clinical trials on patients affected by Intestinal Bowel Disease, where the anti-inflammatory properties of the selected ingredients could be highly beneficial. NANOFOODS project will provide SMEs of the consortium with necessary tools and know-how to introduce in the EU markets foods based on nanoencapsulated bioactive ingredients according to the new European legislation regarding novel healthy foods marketing.

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**NBR: 222023** **ACRONYM: NASPE** **EC FUND: 734800**

**DG:** REA **Call: FP7-SME-2007-1** **Thema:** SME-1

**Title:** NAnomechanical Screening of Pharmaceutical Entities

**Abstract:** Microcantilever (MC) biosensors are innovative and versatile micro-electro-mechanical systems (MEMS). Due to (nano)mechanical transduction of biochemical reactions they allow sensitive, label-free, direct, real-time and multiplexed detection of molecules as well as specific investigations of molecular interactions and conformational changes. NASPE aims at generating the pre-requisites and supporting the effort to establish MC biosensors as a competitive technology in the field of drug screening by integrating skills and know-how of SMEs and RTD performers which cover leading positions in the fields featured by the project. NASPE outcomes are expected to enable the SMEs to strengthen their position in the international market of drug discovery, to gain access to new market segments and to create new highly skilled jobs in Europe. On the other hand, NASPE research activities will contribute to address inherent fundamental issues of MEMS biosensors, including functionalization, manufacturing and novel applications. The primary aim of NASPE is structured into the following SMART objectives: - Functionalization protocols for silicon and plastic MCs, necessary for performing molecular recognition experiments by MCs. They will be accomplished by months 9 and 18, respectively, and tested on conventional fluorescent essays. - Proof-of-concept of nanomechanical drug screening by MCs, that is the necessary step for designing MC essays. Experiments for silicon and plastic MCs will be assessed and statistically validated by month 12 and month 21, respectively. - Prototype plastic MC arrays, that will be provided by month 15 and tested against commercial silicon MCs. Plastic MCs are expected to have lower cost and enhanced performances with respect to silicon MCs. - “Field” test of MC drug screening and design of drug discovery kits, that is the ultimate project objective. MC costs/benefits will be benchmarked against the commercially available drug discovery essays.

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**NBR: 222097** **ACRONYM: SYNTHAFLEECE** **EC FUND: 1017918**

**DG:** REA **Call: FP7-SME-2007-1** **Thema:** SME-1

**Title:** Creation of a synthetic, absorbable, haemostatic fleece for delivery of active agents into healing wounds

**Abstract:** The SME Participants in the SynthaFleece project (NANOVAL, BBS, ASTERIE, STERIPACK) aim to create a new, totally synthetic medical device based on a poly-lactide (PLA) polymer platform that is capable of the sustained release of ionic silver, antibiotics and bone morphogenetic proteins (BMPs) whist stimulating haemostasis and encouraging bone growth and healing. With such a device we can target the market for healing of potentially infected wounds arising from bone and joint surgery worth in excess of €220 million in 2007. To achieve our objective we need to develop new scientific knowledge in: PLA polymer technology and in particular the creation of high density fleece materials for the release of active agents; how the variation of polymer density in a spun-bonded fleece can modify the release characteristics of silver ions, antibiotics and BMPs; the basis for physical and/or chemical induction of haemostasis; and to translate this knowledge into creation of PLA-based micro-fibres to be spun-bonded into a fleece that can bind silver ions, antibiotics and BMPs and release them over a period from seven days to two weeks. The fleece should degrade in the wound bed and be absorbed over the same time period whilst causing immediate and long-lasting haemostasis. Whilst the SMEPs form a complete supply chain for the manufacture of the ultimate fleece product we have neither the facilities nor the resources to undertake the necessary R&D. The Research for SMEs funding instrument provides the ideal solution allowing us to outsource the R&D to three RTD Performers – FhG, HERI and IMM-recherche. The Foreground Intellectual Property (FGIP) generated in the SynthaFleece project will be owned by the SMEPs and exploited in partnership with a large enterprise (BIOMET) which will provide a route to the global market for wound-healing devices. The SMEPs will benefit from sales and licensing of the FGIP to the tune of €XXX million over a ten year period.

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**NBR: 222152** **ACRONYM: FIRELI** **EC FUND: 1054570**

**DG:** REA **Call: FP7-SME-2007-1** **Thema:** SME-1

**Title:** Fire Retardant Line Hoses for Forestry Fire-Fighting Applications

**Abstract:** Fires destroy between 200K and 600K hectares of forest every year in the EU-15, accounting mainly for the Mediterranean countries (Greece, France, Italy, Portugal and Spain), and costing the European economy between 200 and 600 million Euro per year, and a number of live loss. Direct earth fire combat using hoses is a key method used for fighting fires in forestry environments, often used in conjunction with air fighting and other methods. Given the unpredictability of fire in natural environments, versatility and safety are key element to de successful action of the fire brigade. Currently used fire

hoses cannot resist more than 1 minute to a direct fire of 350C, resulting in many cases in hoses burning as a consequence of now fire start ups. This has shown dramatic consequences in fire-fighter´s safety, as well as a decrease in the versatility and efficiency of direct fire combat action plans. The project aims to produce a novel fire-fighting hose system for forestry applications able to provide enhanced versatility, efficiency and safety of fire-fighters in their forestry protection action plans. The hose system will be made of a novel rubber formulation based on PVC/NBR using intumescent additives and fire-resistant components, particularly based on nano-clay inclusions. The hose will provide enhanced fire resistant properties, aiming at increasing current performance by 5 to10 times, while retaining similar mechanical specifications as currently exiting products in the market (weight, service pressure, curvature radius, min temperature, and resistance to abrasion, chemicals, hydrocarbons and ozone) The innovation is expected to impact in other applications for fire-resistant rubbers such as civil, industrial and military. From the scientific point of view, we expect this programme to make a contribution to the understanding of fire resistant composite sciences.

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**NBR: 222219** **ACRONYM: FRACFIX** **EC FUND: 1127808**

**DG:** REA **Call: FP7-SME-2007-1** **Thema:** SME-1

**Title:** Elimination of secondary surgery for removal of internal fixations of fractured bones

**Abstract:** Internal fixation components are widely used in fracture surgery. The medical implant industry is a part of the medical device market generates about €2.4 Bn in Europe and €1.5 Bn in the USA in 2008 and has an estimated annual growth of 10% per year, largely attributed to the aging population in the developed countries. Internal fixation devices market is an estimated €980 Mn in EU25. The total cost of treatment is much higher due the cost of removing the fixation devices, an estimated €3.4 Bn per year in EU25. The idea of FracFix is to develop a fixation system that can be painlessly and easily removed at exact desired moment without surgery and general anaesthesia. During the project a fixator in nano-polymer composite with melting temperature below 50ºC and solid at 41.5 ºC, will be developed to use as the construction material for standard internal fixation parts, as well as an external unit able to melt the material so it can be removed through a 10mm hole in the skin. Internal fixation hardware removal results in high costs for the hospitals and risks and discomfort for the patrient. Removing the need for secondary surgery gives saving of medical personnel's time and average cost of use of recovery room after general anaesthesia is €400 per patient, bringing the total bill of surgery to €1,250 per surgery. The data for combined surgery and trauma suggests that 18.1% of all procedures in the group result in major complications, and 13.5% result in minor complications, adding to morbidity costs to society. At 140,000 internal fixation removal procedures per year in EU and 90,000 in the USA, the estimated yearly death toll due to hardware removal only is 3,192 patients per year in EU25.

**NBR: 222260** **ACRONYM: AXIS** **EC FUND: 1105255**

**DG:** REA **Call: FP7-SME-2007-1** **Thema:** SME-1

**Title:** Advanced X-ray source based on field emitting Carbon Nanotubes cold cathode

**Abstract:** The project develops an innovative x-ray source based on the emerging technology of field emitting carbon nanotubes (CNT). This kind of source has several advantages with respect to traditional sources: higher intrinsic brilliance; possibility to work in pulsed and continuous mode; higher peak power; minor power consumption; modularity of beam size; good stability and longer life time. These sources are also more compact and robust, therefore suitable to be portable. The R&D activity is based on four major blocks: i) development of the cathode made of a well aligned CNT array, capable of delivering high current electron density in continuous and pulsed mode; ii) fabrication of a CNT-based electron gun which combines the CNT cathode with electron focusing optics; iii) integration of the e-gun in x-ray sources, and fabrication of an x-ray microfocusing source with characteristics of high brilliance, continuous and pulsed operation modes, easy control of beam size and power; iv) integration of the microfocusing source in two x-ray systems devoted to specific applications: a tomographic system for biomedical applications and an advanced system for material metrology applications. The implementation of phase contrast imaging methodology with this innovative source will be studied. The project will strongly enhance the competitiveness of the SME's involved in the project. The potential exploitation goes far beyond the examples addressed in the project: X-ray sources are routinely used in medical radiography, in security, in industrial quality control, in advanced research, in environmental issues and in cultural heritage. The availability of innovative sources with improved features with respect to the standard ones will have a great impact not only on Europe competitiveness in this field but also on societal aspects such as health, security, product quality, sustainability.

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**NBR: 222263** **ACRONYM: HEFEST** **EC FUND: 706178**

**DG:** REA **Call: FP7-SME-2007-1** **Thema:** SME-1

**Title:** Smart fire-retardant coatings based on intumescent nanocomposites

**Abstract:** In Europe, annual fire losses reach 80 billion €, meaning more than 1% of EU GDP, 4000 people die and another 80000 suffer terrible burns. The use of fire retarding intumescent coatings play an important role in Fire Safety being this subsector mainly comprised by SMEs. Nowadays, a variety of fire intumescent coatings is available presenting diverse drawbacks such as: poor behaviour when ageing, poor liquid stability,

heat blocking and smoke suppressant properties. Intumescent coatings are obtained by high loadings of reactive components which upon burning swell up creating a protective char layer. HEFEST project aims at developing new intumescent paints and varnishes by means of nanocomposite structures and nanofillers (hybrid organic-inorganic systems, carbon nanotubes…) obtaining halogen-free flame retardants as active intumescent components reactive from nanoscale, with the following advantages: •High durability during service-life (Fire resistance losses< 25% after ETAG 018-part 2 point 5.7.2.2 ageing test) •Liquid stability and easy appliance •Increased heat blocking and protection of the underlying substrate (FR≥90) •Good fire resistance behaviour in the protection of off-shore constructions (good hydrocarbon curve results) •Smoke suppressant properties (30% reduction in gas emission), limitation of spread of fire and smoke within construction works ( ETAG 018) HEFEST counts on a well balanced consortium of 5 SMEs, 2 RTDs and a professional association specialized in organic coatings for the diffusion of the results.. SMEs have in common their conviction on innovation as the best tool to improve their competitiveness in a sector in which big multinationals are ever gaining market share. SMEs partners are complementary and cover the whole project necessities: fire retardants, nanocomposite, resins producers, paint manufacturer and end-users. The RTDs cover the three necessary scientific fields: Coatings, Nanotechnology and resistance to fire.

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**NBR: 222333** **ACRONYM: NANOAIR** **EC FUND: 1073792**

**DG:** REA **Call: FP7-SME-2007-1** **Thema:** SME-1

**Title:** NanoAir, Development of an automated instrument for real-time, on-site qualitative analysis of full-range breathable airborne particles, including nanoparticles, using XRD technology

**Abstract:** There is a need for better measurement instruments for analysis of airborne particles, in particular nanoparticles. Use of powders, nanomaterials/ceramics, and nanoparticles is rising fast. Occupational health problems are present at a wide range of different work places due to airborne particulates. Toxic particles such as asbestos and silica are responsible for the majority of particle related illnesses. The overall impacts of the NanoAir project are to reduce number of deaths and illnesses caused by workplace related exposure to particles. The air pollution detection market is growing fast, as new concerns are identified especially for indoor air pollution. The market is under pressure from USA from many new high-tech solutions, and progression regarding air pollution legislation and NP industries. Thus the concept of the project is to develop a new method to analyse airborne particles, onsite, real-time and with a high quality readout. The method can identify the particle types together with the size distribution. In the project we have a new idea for the development of an improved particle sampling system, which will allow collecting particles with a high efficiency and a wide range of particle sizes, including the nano-size regime. This will allow much improved analysis

results and sensitivity for a wide range of particle types and sizes. This sampling system together with a mobile X-ray diffraction analysis technique opens up for new possibilities within air quality detection, especially within the capability to analyse nanoparticles. Detection and analysis of nanoparticles may be a very crucial field in the future air quality analysis, due to a rapidly increase in use of nanomaterials and nanoparticles in building materials, paintings, cleaning products, cosmetics, etc. At the same time, new research have indicated very large potential risks for man-made nanoparticles, due to a very deep deposition in the lungs and high chemical reactivity.

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**NBR: 222422** **ACRONYM: ECCELL** **EC FUND: 1999999**

**DG:** CNECT **Call: FP7-ICT-2007-C** **Thema:** ICT-2007.8.0

**Title:** Electronic Chemical Cell

**Abstract:** ECCell The aim of the project is to establish a novel basis for future embedded information technology by constructing the first electronically programmable chemical cell. This is naturally a high-risk, embryonic research project, but aimed at a breakthrough which will lay the foundation for immersed micro- and nanoscale molecular information processing with a paradigm shift to digitally programmable chemical systems. Chemical cells must combine self-replication, self-containment and self-regulation of resources (metabolism) enabling evolution to qualify as alive. ECCell will employ novel families of fully synthetic hybrid informational polyelectrolyte copolymers (not simply DNA), which simultaneously support all three cell functionalities. Their microscopic multiphase self-assembly under electric field control is the primary information processing mode of this technology. Realtime digital electric field control sequences, regulating the semi-autonomous self-assembly and reactive molecular processing, will both provide an online programming methodology for these complex systems and potentially serve as electronic genomes for the chemical cells. Programming methodologies (beyond optimal control theory) will be explored and evaluated which deal effectively with the remote real time distributed regulation of these novel semi-autonomous combinatorially complex chemical systems. The research will establish an effective IT interface between microelectronic and molecular information processing, by demonstrating its use to achieve a hard chemical synthetic systems objective (an artificial cell) opening a platform for programming a novel chemical living technology at the microscale.

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**NBR: 222426** **ACRONYM: NANORAY** **EC FUND: 1034880**

**DG:** REA **Call: FP7-SME-2007-1** **Thema:** SME-1

**Title:** Development of a X-Ray tube based on the Field Emission properties of Carbon Nanotubes

**Abstract:** NANORAY aims to realize an innovative device capable to generate X-rays by means of a novel concept of cold cathode, based on carbon nanotubes selectively grown upon ad-hoc synthesized nanostructures (such as vertically oriented nanotubes on metallic tips, selected deposition of CNTs on predetermined areas, array of oriented bundles, etc..) Its performances can be wrapped up by mentioning some of the most relevant features:1)A reduced focal spot (down to 0.1 mm, well below the actual state of art for commercial X-Ray tubes;2)A very low power consumption (due to the use of a field-emission based cathode);3)A pulsed x-ray radiation with programmable width and repetition4)A long life-time.Moreover, the system will be portable, with an overall weight of less than 5 kg (including power supply), allowing the use of X-rays in places like ambulances or in field security surveys. In addition to portability and easiness to use, the system will provide higher image resolution with respect to the state of the art of X-rays devices thanks to the smaller focal spot, and it will represent a cost effective solution for everyone is facing the economic issues related to the maintenance of thermionic cathodes.

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**NBR: 222517** **ACRONYM: ORION** **EC FUND: 2233000**

**DG:** REA **Call: FP7-SME-2007-1** **Thema:** SME-1

**Title:** Optimization of Si solar cells, plastic materials and technologies for the development of more efficient concentRatION photovoltaic systems

**Abstract:** The development of renewable energy is a central aim of the EU Commission's energy policy. Concentration PhotoVoltaics (CPV) has been demonstrated to be a good solution in PV industry and in the last years has become more attractive and several companies have been founded with the main goal of decreasing the cost of PV-generated electricity. The main objective of this project is the optimization of materials and technologies involved in CPV System production to reduce system cost/watt and increase system efficiency. The reduction of system cost/watt, that reflects in reduction of PV-generated electricity, will be achieved by: -developing an all-plastic system by using recycled plastic compounds; -developing Si solar cells for automatic assembling technology; -implementing and industrializing automated high-rate technologies for cell assembly and optics production. The increase of system efficiency will be achieved by: -increasing Si concentration cell efficiency by using surface plasmonic crystal structures; -developing plastic materials doped with down-converting nanoparticles for modification of the solar spectrum to enhance the cell efficiency. The scientific objectives concern optimization of Si solar cell and the development of new application-addressed nanocomposite thermoplastic material. Technological objectives concern the implementation and industrialization of automated low-cost technologies for CPV components fabrications. The scientific and technological objectives of the project will

be exploited by the realization of a low –CPV system with a projection 2-3 €/Watt . The new system, ready to be produced at the end of the project, will be based on Si concentration solar cell technology coupled to hybrid mirror-lens concentrator optical system. The project also includes the design and development of an innovative one-axis tracker integrated with optics for the realization of a compact and modular CPV system for domestic rooftop applications.

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**NBR: 222618** **ACRONYM: BILAT-RUS** **EC FUND: 492888**

**DG:** RTD **Call: FP7-INCO-2007-2** **Thema:** INCO-2007-2.1

**Title:** Enhancing the bilateral S&T Partnership with the Russian Federation

**Abstract:** BILAT-RUS focuses on enhancing the bilateral S&T Partnership between Russia and the EU. The project aims at contributing to the implementation of the Common Space on Research between the EU and Russia. It will ensure coherence and coordination of various activities under the umbrella of the EU-Russian S&T agreement and will contribute to a stronger coordination of bilateral activities with Russia at EU and Member State level. The major objectives of BILAT-RUS are: • to facilitate coherent information dissemination and awareness raising on EU-Russian cooperation (database on S&T research institutes, case studies on good cooperation practice, web-portal, partner search tool, information events); • to contribute to the optimisation of the framework and the instruments for enhanced future EU-Russian cooperation (inventory of existing instruments and regulations, examples of good cooperation practice, options for optimising the common legal and organisational frame, suggestions for practical and efficient joint funding mechanisms); • to create a knowledge base for emerging horizontal issues of cooperation (mobility, S&T infrastructure and innovation); • to meet the needs of joint thematic EU-Russian Working Groups on S&T cooperation (Health, Food/Agriculture/Biotechnology, Nanotechnology, Energy); • to exploit the potential of Russian Mirror Technology Platforms through linking them with their European counterparts. The project proposal for BILAT-RUS is built on joint EU-Russian interest and aims at mutual benefit. Synergies will be established with other bilateral or bi-regional EU-Russian projects from FP6 and FP7 (such as SCOPE-EAST and the upcoming IncoNet EECA targeting Eastern Europe and Central Asia), bilateral S&T agreements and other initiatives between the EU Member States and Russia. The consortium consists of ten partners (five of them from Russia) with in-depth experience of EU-Russian cooperation in S&T. The Russian NCPs are associated partners.

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**NBR: 222620** **ACRONYM: ARASCOM** **EC FUND: 2600000**

**DG:** CNECT **Call: FP7-ICT-2007-2** **Thema:** ICT-2007.3.6

**Title:** MEMS and Liquid Crystal based, Agile Reflectarray Antennas for Security and COMunication

**Abstract:** ARASCOM OBJECTIVES Our project is focused on Research & Development for efficient use of micro-nano devices as basis of agile antennas with moderate cost, that are more and more required in advanced systems for Communication, Safety and Security. We will assess this until representative prototypes at a very large and innovative level: · very large because the developed agile "reflectarray" antennas for Communication (to be implemented in base-stations and satellites) will comprise thousands of RF-MEMS switches integrated in the radiating board for phase-controlling the reflected waves · innovative: first because such quantities will require both accurate & safe design, and setting-up industrial processes including on-wafer packaging and automatic assembling, to reach higher reproducibility in top-level performances (improving reliability) than previous European projects on RF-MEMS · innovative especially because to operate at the very high frequencies suited to security imaging, safe-landing & anti-collision radar (typically around 77 GHz), will be developed new phase-shifters combining MEMS with nematic Liquid Crystals ; the latter provide variable permittivity by adjusting molecules orientation, so may be called "nano-scale control devices". So both Micro (MEMS) & Nano (nematic LC) technologies will be deeply investigated, for their best properties in agile antennas. PROJECT TEAM To reach the presented objectives, we gathered 9 complementary partners from 4 large member-states: - 3 among the best European academies for MEMS & LC design (U. Perugia, T.U.Darmstadt), as for reflectarray antennas (U.P.Madrid & Perugia) - 2 public Research institutes, leaders for RF-MEMS development over a large range of frequencies (LETI, FBK) - 4 industrial end-users among the main players in Communication, Security & Safety: SELEX-SI for concealed weapon detection, EADS-Innovation Works for helicopters landing radar, Thales Alenia Space for satellites and S.R.F.Moyano for base-stations.

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**NBR: 222824** **ACRONYM: HIGHTECH EUROPE** **EC FUND: 5865354**

**DG:** RTD **Call: FP7-KBBE-2007-2A** **Thema:** KBBE-2007-2-3-06

**Title:** European Network for integrating novel technologies for food processing

**Abstract:** The Network of Excellence HighTech Europe facilitates the implementation of high-tech processing at industrial scale via strongly connected regional knowledge transfer chains consisting of basic-applied science centres (12 in total), industry federations (4), Innovation Relay Centre (1) and SMEs (5). Its main aim is to identify, develop and demonstrate potential, cost-efficient, innovations to be used by SMEs via a Science Cube approach and availability of high-tech pilot facilities. This approach links innovation sources (bio-, nano- and information and communication technologies), scientific

principles and food engineering operations. In addition, industrial needs are mapped and linked with the results from the Science Cube approach, using a novel Lighthouse Watcher concept. New routes for implementation are developed such as a Knowledge Auction and an Implementation Award honouring full chain innovations. Next, knowledge transfer schemes elucidate feasibility studies and business cases based on unique patent portfolios convincing entrepreneurs and early adopters to acquire 'lead market' positions. Here, ethical, legal, social aspects and consumer perception regarding high-tech food processing are taken into account in order to set up a first, well-balanced Agenda of the White Book on high-tech food processing for policy and regulatory bodies. Dissemination of European findings and training & career development, especially for young scientists sharing spirit and enthusiasm with their senior colleagues in the Network of Excellence, allow attracting new stakeholders and next generations for a durable network finally merging into the future European Institute for Food Processing. Herein, critical mass and joint initiatives at the interface of the Food Manufacturers and Technology Providers substantially increase the innovation rate and competitiveness of the European Agro-Food sector.

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**NBR: 222980** **ACRONYM: BETAIMAGE** **EC FUND: 5447136**

**DG:** RTD **Call: FP7-HEALTH-2007-B** **Thema:** HEALTH-2007-2.4.3-9

**Title:** Use of innovative strategies for beta-cell imaging in diabetes mellitus

**Abstract:** The development of sensitive, non-invasive methods for the characterisation and quantification of beta-cell mass would greatly enhance our means for gaining understanding of the pathophysiology of diabetes and allow the development of novel therapies to prevent, halt and reverse the disease. The aim of this project is to develop and apply innovative approaches for beta-cell imaging, the emphasis being on beta-cell mass regulation (loss and neogenesis) with the perspective of entering initial clinical trials. For this purpose, our approach is to: (1) Focus on imaging technologies offering the potential to enter clinical trials during the runtime of the project. Since beta cells contribute only marginally (1-2%) to the total mass of the pancreas, a highly sensitive method for clinical imaging is required. BETA IMAGE will focus on positron emission tomography (PET) relying on chemical resolution, i.e. the specificity of a radiolabelled tracer molecule. The lead compound will be radiolabelled Exendin 4, developed in the consortium for GLP-1 receptor imaging. (2) Devise novel imaging strategies by generating labelled "design" molecules/peptides/nanobody molecules targeting newly identified beta-cell surface proteins. These targets will be identified using a Systems Biology approach. For high-throughput tracer development, a stream-lined methodology will be established based on in vitro model systems and micro-/macroscopic in vivo real time dynamic imaging of tracer distribution by optical coherence tomography and complementary small animal PET and MRI. (3) Build on European excellence in tracer development using peptides, peptide-like and organic molecules for different imaging

modalities. To achieve these ambitious goals, we have established a highly interdisciplinary and interactive project combining leading European research groups. In this way, a unique expertise is achieved regarding tracer development and imaging, beta-cells/diabetes and target definition.

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**NBR: 223048** **ACRONYM: NANOTRYP** **EC FUND: 2714608**

**DG:** RTD **Call: FP7-HEALTH-2007-B** **Thema:** HEALTH-2007-2.3.4-1

**Title:** Exploiting Nanobodies in development of new diagnostic tools and treatment methods for Trypanosomiasis.

**Abstract:** African trypanosomiasis is in need of new diagnostic detection tools and new treatment methods. To date the widely used card agglutination test for trypanosomiasis is not very specific as the test is based on the screening for cross-reactive host antibodies. The availability of treatment for Trypanosmiasis on the other hand is limited due to the fact that only very few drugs are registered for use, and all can cause serious side effects in treated patients or animals. Hence, this project will focus on the development of new and innovative diagnosis and treatment tools, using the nanobody technology that has been developed by the coordinating partner of this network. Nanobodies are small single domain antibody fragments that have unique properties that include their capacity to recognize particular epitopes (not recognized by conventional antibodies) and their improved stability. In addition, they can be used as molecular target- or transport devices of other biological active components. As such they are excellent tools to support this project. Despite the fact that the coordinating laboratory has been a pioneer in differential molecular characterization of African trypanosomes and were involved in the initial release of diagnostic PCR methods that have now been adopted by many other research groups, this project will deliberately adopt a different approach. Indeed, in comparison to nanobody technology, PCR based diagnostics are much more costly and require an infrastructure that is hard to sustain over prolonged periods of time in African 'field situations'. The simplicity of the nanobody technology on the other hand makes it an excellent topic for knowledge transfer. Despite it's high-technology approach, the technique it will be relatively easy to be adopted by laboratories of participating African partner groups.

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**NBR: 223298** **ACRONYM: PURSTEM** **EC FUND: 2750367**

**DG:** RTD **Call: FP7-HEALTH-2007-B** **Thema:** HEALTH-2007-1.4-7

**Title:** Utilisation of the mesenchymal stem cell receptome for rational development of uniform, serum-free culture conditions and tools for cell characterization

**Abstract:** Stem cells offer a promising avenue to therapy for a wide range of complaints. However, for this potential to be realized, a consistent and plentiful supply of well-characterised stem cells is essential. There has been relatively little progress in the development of new culture technologies for the large-scale manufacture of mesenchymal stem cells (MSCs). There is a strong possibility that this limited ability to produce stem cells will result in delays to the translation of new therapies to the clinic. This will have a direct negative effect on the health of European citizens suffering from diseases untreatable by conventional medical technology and delay European efforts to promote "NanoMedicine - Nanotechnology for Health". PurStem will progress the state of the art in the production of mesenchymal stem cells (MSCs) in large quantities. The current state of the art has several weaknesses - there are no standards for characterisation, isolation or identification of MSCs from any tissue, nor are there standard protocols for differentiation of MSCs to various lineages. Additionally, surface markers used for MSC characterization lack specificity and cryopreservation protocols are not standardized. Critically, current production methods for MSC require the use of animal products with major contaminant implications. PurStem will • Identify the MSC "receptome" and • Use this repertoire of growth factor receptors to • Develop novel serum-free media for MSC production. PurStem will also result in novel antibody reagents for specific MSC characterization and contribute to GMP manufacturing standards to enable rapid progression to production of serum-free MSC for clinical applications. The impact on a range of therapeutic and research domains of having a reliable supply of industrial levels of categorised MSCs will be significant. PurStem represents a key enabler for stem cell applications in a range of therapeutic fields.

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**NBR: 223378** **ACRONYM: HIPERDART** **EC FUND: 2999882**

**DG:** RTD **Call: FP7-HEALTH-2007-B** **Thema:** HEALTH-2007-1.1-4

**Title:** Development of High Performance Diagnostic Array Replication Technology

**Abstract:** Development of High Performance Diagnostic Array Replication Technology (HiPerDART) As with any new technology, the use of DNA microarrays has presented a number of important obstacles, many of which have limited their ability to move beyond research applications. For example, the data obtained from a traditional microarray experiment can fluctuate dramatically due to small perturbations in assay conditions. This fact, when coupled to the often extensive workflows required to perform an assay, has caused many experts to conclude that microarrays are not well suited to clinical applications. Other factors as limited content flexibility and high production costs contribute to this negative image. It is the aim of the present HiPerDART project to develop a higher standard (clinical) microarray technology platform, by proposing a highly innovative

probe printing technology, called Supramolecular NanoStamping (SuNS). Moreover, since at the same time in HiPerDART both assay workflow will be minimized and signal-to-noise ratios will be improved, our technology platform promises to dramatically improve the reliability (reproducibility and costs) of these (medical) tests. Furthermore, in an industry dominated by U.S. players, it is imperative to establish a strong European presence at this early stage in the development of the clinical market. By using a complex disease as colon cancer to prove the strength of the HiPerDART microarray technology platform, already in the limited lifetime of this project a first HiPerDART diagnostic microarray test will be validated.

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**NBR: 223431** **ACRONYM: DIVINOCELL** **EC FUND: 5956086**

**DG:** RTD **Call: FP7-HEALTH-2007-B** **Thema:** HEALTH-2007-2.3.1-1

**Title:** Exploiting Gram-negative cell division targets in the test tube to obtain anti-microbial compounds

**Abstract:** The DIVINOCELL project will identify novel Gram-negative targets by exploiting the components of the divisome, their activities and interactions. It will also design selective assays for screening and will obtain a new class of antimicrobials: compounds to block bacterial division. New medicines to attack Gram-negative pathogens will decrease the burden of infectious disease and have a highly beneficial social and economic impact in Europe and beyond. Cell division is an essential and still underexploited process with excellent properties to yield new inhibitors to attack infection by blocking the proliferation of pathogens. Inhibitors directed against bacterial division targets, that are not present in eukaryotic cells, will be both effective and innocuous to humans and animals. In addition, as many of their structures will be based on interaction domains and synthetic scaffolds, they will generate resistance at levels lower than the present antibiotics. DIVINOCELL will apply existing and new knowledge on the molecular biology of Gram-negative cell division as well as novel analytical (nanodiscs), bioinformatic (molecular dynamics), structural (membrane protein crystals) and imaging (lanthanide staining) tools to exploit in the test tube the structures and interactions of targets in the divisome and the septum. DIVINOCELL will develop potent systematic screening assays and will use them to select compounds specifically tailored to inhibit the division of Gram-negatives (not precluding broad spectrum ones). Secondary activity and cell assays, based on the properties of bacterial division, will be generated to validate hits and advance them to leads. The medicinal properties of selected leads will be improved. The translational steps of the project will be developed by 4 SMEs in close collaboration with the 8 academic partners having well-proven expertise in molecular microbiology, protein chemistry, structural biology, biophysics, imaging and bioinformatics.

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**NBR: 223807** **ACRONYM: BALTICGRID-II** **EC FUND: 2998000**

**DG:** CNECT **Call: FP7-INFRASTRUCTURES-2007-2** **Thema:** INFRA-2007-1.2-03

**Title:** Baltic Grid Second Phase

**Abstract:** The Baltic Grid Second Phase (BalticGrid-II) project is designed to increase the impact, adoption and reach, and to further improve the support of services and users of the recently created e-Infrastructure in the Baltic States. This will be achieved by an extension of the BalticGrid infrastructure to Belarus; interoperation of the gLite-based infrastructure with UNICORE and ARC based Grid resources in the region; identifying and addressing the specific needs of new scientific communities such as nano-science and engineering sciences; and by establishing new Grid services for linguistic research, Baltic Sea environmental research, data mining tools for communication modelling and bioinformatics. The e-Infrastructure, based on the successful BalticGrid project, will be fully interoperable with the pan-European e-Infrastructures established by EGEE, EGEE associated projects, and the planned EGI, with the goal of a sustained e-Infrastructure in the Baltic Region. The present BalticGrid e-Infrastructure of 26 clusters in five countries is envisaged to grow, both in capacity and capability of its computing resources. The consortium is composed of 13 leading institutions in seven countries, with 7 institutions in Estonia, Latvia and Lithuania, 2 in Belarus, 2 in Poland, and one each in Sweden and Switzerland. The overall vision is to support and stimulate scientists and services used in the Baltic region to conveniently access critical networked resources both within Europe and beyond, and thereby enable the formation of effective research collaborations.

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**NBR: 223832** **ACRONYM: NANOPACK** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2007-4-3-IRG** **Thema:** PEOPLE-2007-4-3.IRG

**Title:** Multifunctional Nanomaterials for Intelligent Food Packaging Applications

**Abstract:** There is a great need for rapid, accurate, cost effective, reliable, non-invasive and non-destructive sensing platforms to evaluate real-time quality of food products. Integration of such devices into intelligent packaging systems provides an efficient tool for real-time monitoring of food quality, facilitating food safety and biosecurity. The main objective of the suggested research is to develop novel multifunctional nanomaterials and devices that could in future power intelligent forms of food packaging. The materials will be based on elctroochemically-prepared nanostructured inorganic porous scaffolds, composed primarily of silicon (Si) and silicon oxide (SiO2) and their hybrids with various polymers/hydrogels. These materials will be designed to perform different tasks, including detecting, sensing, biosensing, and tagging. An emphasis will be made on the interaction of these devices with food, their long term stability and their integrability

with conventional food packaging platforms. The potential of the suggested technology is far reaching, and is expected to have an impact on numerous disciplines including, packaging science, food science, biotechnology, polymer science, nanotechnology and sensor science.

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**NBR: 223849** **ACRONYM: EUROTRAINING-MST** **EC FUND: 499953**

**DG:** CNECT **Call: FP7-ICT-2007-2** **Thema:** ICT-2007.3.6

**Title:** Establishment of microsystems training requirements in Europe

**Abstract:** The objective of the EuroTraining-MST proposal is to provide a European Training Infrastructure facilitating the provision of high calibre training across Europe. The structure will support professional advancement training as well as academic training. Professional course providers will get a central place for the presentation of their training offer while academics will get a course material exchange service targeting graduate nanoelectronics schools.

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**NBR: 223850** **ACRONYM: NANODATACENTERS** **EC FUND: 3010000**

**DG:** CNECT **Call: FP7-ICT-2007-2** **Thema:** ICT-2007.1.6

**Title:** Nano Data Centers

**Abstract:** The project proposes a radical solution to data hosting and delivery for the Internet of the future. The current data delivery architecture is “network centric”, with content stored in data centers connected directly to Internet backbones. This approach has multiple drawbacks among which complexity of deploying data centers, power consumption, and lack of scalability are the most critical. The ECHOS project takes a totally innovative and orthogonal approach to traditional data centers, through what we call “nano” data centers, which are deployed in boxes at the edge of the network (i.e. in home gateways, set-top-boxes, etc.) and accessed using a new peer-to-peer communication infrastructure. This disruptive evolution solves most of the inconveniences of current data center based solutions, and allows for the deployment of next generation interactive applications. However, this creates a number of challenges as data has to be accessed and assembled dynamically “on-demand”, in real-time. ECHOS will design and develop the nano-data center communication architecture with security and incentive mechanisms. We will demonstrate that ECHOS is a cheap and scalable alternative to the current data hosting and delivery model. The full ECHOS architecture will be implemented (i.e. an ECHOS box will be fully specified and implemented). Virtualization will be used to partition and manage box resources

efficiently. Two interactive applications – multiplayer games and VoD – will be designed as a proof of concept. A large scale testbed will be deployed to evaluate the benefits and performance of ECHOS. We will contribute the ECHOS architecture to the relevant standardization bodies and to discussion groups on the design of the Internet of the Future. The project is in line with the Strategic Research Agenda (SRA) of the NEM initiative. The project is expected to lead to the commercialization of the ECHOS box. This will result in a competitive advantage for European industry and SMEs.

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**NBR: 223876** **ACRONYM: HISTORIC** **EC FUND: 2300000**

**DG:** CNECT **Call: FP7-ICT-2007-2** **Thema:** ICT-2007.3.5

**Title:** Heterogeneous InP on Silicon Technology for Optical Routing and LogIC

**Abstract:** HISTORIC proposes to design, develop and test digital photonic integrated circuits containing a relatively large number of active photonic elements combined with passive elements, for use in e.g. all-optical packet switching for both datacom and telecom. The building blocks for the digital photonic circuits are ultra-compact gates based on micro-ring or micro-disk lasers, photonic crystal lasers or metallic nanocavity (or plasmonic) lasers. These lasers are fabricated making use of the heterogeneous integration of InP membranes on top of silicon on insulator passive optical circuits. Different approaches for the ultra compact lasers will be investigated, allowing to make use of the high precision growth and processing techniques available to the InP platform, as well as to take advantage of the extreme accuracy of state-of-the-art CMOS processing. Several all-optical flip-flops and gates will be integrated on a single chip, and will be interconnected by short wire waveguides in the SOI structure. The extremely small dimensions of both the flip-flops, gates and their interconnections will result in a competitive footprint of optical packet switches as compared with electronic switches. The targetted ultra small dimensions of the laser-based all-optical flip-flops are expected to result in record low switching times and switching energies. Together with the low propagation losses in the SOI waveguides, this is expected to result in a competitive speed and power consumption of optical packet switches. The possibility of integrating a large number of photonic digital units together, as well as integrating them with compact passive optical routers such as AWGs, opens new perspectives for the design of integrated optical processors or optical buffers. The project will therefore also focus on designing new architectures for such optical processing or buffer chips. Extensive characterisation and system tests will demonstrate the advantage of the new optical approach.

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**NBR: 223927** **ACRONYM: E-STARS** **EC FUND: 2599933**

**DG:** CNECT **Call: FP7-ICT-2007-2** **Thema:** ICT-2007.3.6

**Title:** Efficient Smart sysTems with enhAnced eneRgy Storage

**Abstract:** E-STARS project aims at developing enhanced sensing and communication capability on an autonomous smart micro system powered by a new 3D high capacity integrated micro battery. According to the experts, the market of wireless smart sensors should generate revenues more than 5 billion euro in 2011 (source: http://www.rfidjournal.com). Faced with such future strong technical and economical impact, it is of strategic importance to maintain the Europe¿s leadership in these domains. Considered as an RandD topic of high relevance in such domain (EpoSS Strategic Research Agenda), the energy-management, scavenging and storing techniques aspects will be particularly investigated by the E-STARS project. The objective is to reach higher energy-management and autonomy performance packed in a smaller volume. The innovative 3D architectures micro batteries will increase by 5 to 10 the battery capacity (from 100 µAh/cm² to 1 000 µAh/cm²) and power (from 5 mW/cm² to 50 mW/cm²) compared to traditional solutions. To do so, the consortium will investigate completely new deposition processes for micro battery layers such as Chemical Vapor Deposition (CVD), electrospraying and electrodeposition in order to obtain 3D higher aspect ratio aspects. The consortium involves well known complementary research partners (CEA, TUDELFT and UNIVERSITY of PARIS XI), industrial partners (MOTOROLA, STMICROELECTRONICS), as well ad SME¿s (BIOAGE and CORA TINE TEORANTA) from 5 EU countries. As a STREP project, E-STARS addresses clearly the objective 6 of challenge 3 of the ICT call 2 : Micro/nanosystems. The targeted applications within the project are : wearable intelligent micro sensors, wireless networked sensors associated to an intelligent data to internet platform and innovative nanogravimetric sensors and biosensors. More globally, thanks to an optimized dissemination of the result, the project will provide the EU industry with new highly autonomous wireless sensors to face the strong competition in this field.

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**NBR: 223998** **ACRONYM: SENSHY** **EC FUND: 2350000**

**DG:** CNECT **Call: FP7-ICT-2007-2** **Thema:** ICT-2007.3.5

**Title:** Photonic sensing of hydrocarbons based on innovative mid infrared lasers

**Abstract:** The SensHy proposal focuses on novel photonic gas sensors for the detection of hydrocarbons. Hydrocarbons can be detected most sensitively in the 3.0 to 3.6 µm wavelength range. Two particular challenging applications with significant market potential are investigated within the project. Unfortunately there are no application grade semiconductor lasers in this wavelength range yet: On the short-wavelength side of this range interband lasers are available (RT cw operation for emission up to about 3.0 µm), while intraband quantum cascade lasers were demonstrated on the long-

wavelength side (RT cw operation for emission above about 3.8 µm). An additional complication for applications in gas detection is given by the maximum available tuning range for suitable mono mode laser diodes, which is currently limited to a few nanometers. Concepts for an increased tuning range have so far been predominantly investigated at wavelengths around 1.55 µm for telecom applications. The aim of the SensHy proposal is to overcome these limitations and to achieve the following goals: - realize GaSb based laser material enabling RT cw operation in the wavelength range from 3.0 to 3.6 µm - develop multi-section DFB/DBR Lasers with increased electrical tuning capability - demonstrate highly sensitive hydrocarbon detection making use of widely tuneable lasers and novel digital-signal-processing schemes to identify various gas constituents within a multi-component hydrocarbon gas mixture In order to reach these goals significant challenges have to be overcome in various fields ranging from epitaxial semiconductor growth via laser design and processing to mid infrared sensor development of the project. For this the consortium comprises renowned research groups, academic and industrial partners including SMEs from across Europe with a range of complementary competencies covering all aspects from semiconductor material and characterization to photonic components and sensor systems.

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**NBR: 224001** **ACRONYM: TERAMAGSTOR** **EC FUND: 3450000**

**DG:** CNECT **Call: FP7-ICT-2007-2** **Thema:** ICT-2007.3.6

**Title:** TERABIT MAGNETIC STORAGE TECHNOLOGIES

**Abstract:** The TERAMAGSTOR project aims through a systems approach at designing, fabricating and testing future perpendicular magnetic storage media with areal density larger than 1 Tbit/in2. To overcome the technological barriers limiting the areal density, the proposed approaches address both key media feasibility issues (thermal stability, writability, signal to noise ratio) and low cost, high throughput media fabrication methods. The approaches are based on the development of advanced film media (exchange spring and percolated media), nanolithographically patterned and nanoparticles patterned by templates through an integration of professional skills (chemists, physicists, engineers, materials scientists).The activity will cover media preparation and characterisation, magnetization reversal processes, numerical micromagnetic simulations, measurements of write/read recording characteristics and signal modelling and processing. The innovation and the ultimate goal is to produce the first EU 1.8 /2.5 HD with density in excess of 1 Tbit/in2 , through synergistic approach using EU groups and the exploitation by the two IND .It is based on previous work by most of the consortium members, which led to a record of 220 Gbits/in2 (Descartes prize 2005). The expected impact of TERAMAGSTOR is to open the way to a new generation of ultrahigh density magnetic recording media, through a basic investigation of magnetic phenomena in the nanoregime and the development of new fabrication

processes, favouring the EU technological progress and competitiveness in the key technological area of magnetic storage and in general to the ICT business.

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**NBR: 224012** **ACRONYM: TIME** **EC FUND: 3650000**

**DG:** CNECT **Call: FP7-ICT-2007-2** **Thema:** ICT-2007.3.6

**Title:** Transverse, Intrafascicular Multichannel Electrode system for induction of sensation and treatment of phantom limb pain in amputees

**Abstract:** Amputation of a limb is a surgical intervention used as a last resort to remove irreparably damaged, diseased, or congenitally malformed limbs where retention of the limb is a threat to the well-being of the individual. The procedure traumatically alters the body image, but often leaves sensations that refer to the missing body part, the phantom limb. In 50-80% of cases, these sensations are painful and currently, there are no effective treatment modalities. Given sufficient control over a large number of nerve fibers, a neural interface may be able to artificially evoke sensations of touch, or counteract the phantom limb pain. The application of Micro/nano technologies with functional electrical micro stimulation can not only pave the road towards a treatment, but also also provide amputees a means to sense virtual environments directly. The ultimate aim of this project is to develop this novel Human Machine Interface (HMI). A novel microfabricated neural interface, the Thin-film Intrafascicular Multichannel Electrode array, and implantable multichannel stimulator system will form the key core technological developments in the project. The work is structured in 10 work packages in three phases. The technological development phase will model, design, manufacture and characterize the multi-channel electrode (TIME) and design, manufacture and test an implantable, multi-channel stimulator. In vivo characterization phase will evaluate the TIME electrodes for biocompatibility, stability and chronic safety in animals and develop a psychophysical test platform for system integration. Finally, pre-clinical evaluation will test the system in short-term implants in amputee subjects. The work will provide direct contribution to the next-generation smart systems in the ICT-2007.3.6 Nano/Micro priority, strengthen Europe's leading position in advanced electronic systems/biomedical applications, and improve the quality of life for amputees with phantom limb pain

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**NBR: 224176** **ACRONYM: ACTION-GRID** **EC FUND: 999077**

**DG:** CNECT **Call: FP7-ICT-2007-2** **Thema:** ICT-2007.5.3

**Title:** International Cooperative Action on Grid Computing and Biomedical Informatics between the European Union, Latin America, the Western Balkans and North Africa

**Abstract:** Topic: ACTION-Grid is a Specific International Cooperation Project on healthcare information systems based on Grid capabilities and Biomedical Informatics (BMI) between Latin America, the Western Balkans and the European Union (EU). Background: Members of the consortium have published pioneering scientific papers in Grid and BMI. They participated in the BIOINFOMED and SYMBIOMATICS studies that contributed decisively to the last two FPs of the EC. Main objective: ACTION-Grid will act as a multiplier of previous outcomes in Grid and BMI. ACTION-Grid will disseminate these outcomes in Latin America, the Western Balkans and North Africa. Subobjectives: (1) To survey Grid-based and BMI initiatives in Europe, Latin America, the Western Balkans and North Africa. These results will be combined with data from an inventory of Grid/Nano/BMI methods and services—, developed by the consortium. (2) Based on previous EC-based projects, ACTION-Grid will foster training and mobility in Grid and BMI. (3) To develop a White Paper, in collaboration with a panel of recognized experts. This document will be delivered to the EC to establish a future agenda covering the Grid/Nano/Bio/Medical Informatics areas and develop new plans in Latin America, the Western Balkans and North Africa. (4) To disseminate ACTION-Grid, by means of: (a) An international symposium on Grid and BMI. This conference will be carried out in Europe, with two satellite conferences (b) Scientific publications, (c) Dissemination strategies, such as a Website, Newsletters, Press releases, etc. Expected impact: To expand previous initiatives to create a common health information infrastructure in Europe, and extending it to other regions. It will enhance cooperation between research centres, universities, hospitals, SMEs, public entities, and others. ACTION-Grid will expand the impact of EC achievements in Grid and BMI to researchers, educators, and health practitioners world-wide.

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**NBR: 224205** **ACRONYM: MICROFLUID** **EC FUND: 3200000**

**DG:** CNECT **Call: FP7-ICT-2007-2** **Thema:** ICT-2007.3.6

**Title:** micro-Fabrication of polymeric Lab-on-a-chip by Ultrafast lasers with Integrated optical Detection

**Abstract:** Lab-on-chips (LOCs) are microsystems capable of manipulating small (micro to nanoliters) amounts of fluids in microfluidic channels with dimensions of tens to hundreds of micrometers: they have a huge application potential in many diverse fields, ranging from basic science (genomics and proteomics), to chemical synthesis and drug development, point-of-care medical analysis and environmental monitoring. Polymers are rapidly emerging as the material of choice for LOC production, due to the low substrate cost and ease of processing. Notwithstanding their potential, LOC commercial exploitation has been slow so far. Two breakthroughs that could promote LOC diffusion

are: (i) a microfabrication technology with low-cost rapid prototyping capabilities; (ii) an integrated on-chip optical detection system. In this project we propose the use of femtosecond lasers as a novel highly flexible microfabrication platform for polymeric LOCs with integrated optical detection, for the realization of low-cost and truly portable biophotonic microsystems. Femtosecond laser processing is a direct, maskless fabrication technique enabling spatially selective three-dimensional material modification. It will be employed in different steps of the LOC production cycle: (i) rapid prototyping of the microfluidic chip using laser ablation or two-photon polymerization; (ii) direct fabrication of optical waveguides and integrated photonic components on the LOC for in situ optical sensing; (iii) master tool fabrication for mass production by replication techniques. The laser fabrication technology will enable to implement a variety of microfluidic LOCs with integrated photonic functionalities. In this project we concentrate on two prototypical applications in the fields of food quality and environmental sensing: LOCs for detection of mycotoxins in animal feeds and LOCs for water screening to detect bacteria and heavy ions contamination.

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**NBR: 224211** **ACRONYM: VISIT** **EC FUND: 2350000**

**DG:** CNECT **Call: FP7-ICT-2007-2** **Thema:** ICT-2007.3.5

**Title:** VISIT - Vertically Integrated Systems for Information Transfer

**Abstract:** The proposed STREP focuses on strategic, high-value photonic components and subsystems for scalable economic broadband access and local area networks. The central objective is research on, development, test and exploitation of system-enabling optical transmitters having a completely novel design and/or largely improved functionality as compared to the state of the art. Three key design and performance advancements will overcome limitations of present devices to become future-proof drivers of the European photonics industry: A novel nanophotonic approach of vertical integration of an electro-optic reflectance modulator and a laser implemented into: a) Vertically Cavity Surface Emitting Lasers based on Electro-Optically Modulated Bragg Reflector and b) Edge emitters based on Electro-Optically Modulated Tilted Wave Lasers constituting the basis for future access, local (LAN) and storage area (SAN) networks capable to speeds well beyond 40Gb/s. c) For applications at 16-40 Gb/s (Fibre Channel, InfiniBand standards) a new generation of directly-modulated VCSELs will be developed to bridge the intermediate bandwidth demand in the fastest possible time frame. Epitaxial growth of these structures, processing and design of high-frequency modules will be challenging and demand detailed modelling. The wavelength ranges to be covered are 850 nm, 980 nm, and 1.3 µm. While 850 nm (LAN, SAN) and 1300 nm (LAN, Access Networks) ranges are standard for applications, 980 nm devices may play an important role for very short links. Low power driver circuitry, as well as system integration and performance requirements will be also dealt with within this project. Upon completion a full supply chain from production of epitaxial wafers to test beds for

measurements and prototype systems will be established. The economic impact of this work will be systematically enhanced by contributing directly to international standardization activities and roadmaps of this area.

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**NBR: 224212** **ACRONYM: DOTSENSE** **EC FUND: 1223789**

**DG:** CNECT **Call: FP7-ICT-2007-2** **Thema:** ICT-2007.3.5

**Title:** Group III-nitride quantum dots as optical transducers for chemical sensors

**Abstract:** The objective of DOTSENSE is the application of III-nitride (InxGa1-xN) quantum dots (QDs) and nanodisks (NDs) as opto-chemical transducers for the detection of hydrogen, hydrocarbons and the pH-value in gaseous and liquid environments. The characteristics of intense room-temperature luminescence from III-nitride nanostructures can be altered by chemically induced variations of the surface potential. The transparency of the substrate material and the involved buffer layers allow optical excitation and detection of the changes in QD or ND luminescence from the substrate backside. These transducers are hence capable of operating in harsh environments (high pressure, explosive media), as neither electrical feedthroughs nor a deterministic current are necessary for the sensor signal read-out. Furthermore, spatially-resolved detection of variations in the surface potential is possible, since the spatial extension of excited nanostructures is determined by the diameter of the incident light beam. In the first part of the project, the work is focused on the optimization of the structural properties of QD and ND ensembles (size, alloy composition, number of layers, crystallographic orientation) with the aim of attaining a maximum sensitivity of the emission properties (intensity and energetic distribution) upon variations in the surface potential. In a second stage, the opto-chemical transducers will be integrated with commercially available light emitters and detectors, to implement different kinds of sensor systems, which demonstrate and exploit the advantages of this innovative transducer concept. This prototypes find application in the field of aeronautics, with a the potential to increase the safety and/or the economy of flying.

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**NBR: 224226** **ACRONYM: SURPASS** **EC FUND: 3448917**

**DG:** CNECT **Call: FP7-ICT-2007-2** **Thema:** ICT-2007.3.6

**Title:** SUper-Resolution Photonics for Advanced Storage Systems

**Abstract:** The purpose of the restructured SURPASS project is to develop key technologies to achieve super-resolution beyond the diffraction limit in air at visible wavelength. The application fields covered by the project are optical data storage, wafer inspection,

maskless optical lithography and confocal microscopy. The first super-resolution technology is based on so-called super-RENS materials (Super-Resolution Enhanced Near-Field Systems). These materials, such as the semiconductor InSb, undergo a local modification of their refractive index properties above a certain power threshold of a focused laser spot. As a consequence they produce a reduction of the effective size of the laser spot. Super-RENS materials are developed mainly for optical ROM discs to allow the readout of recorded marks smaller than the resolution limit of the optical readout system. The maximum capacity of single-level Super-RENS discs will be studied theoretically and experimentally. In parallel, semi-transparent Super-RENS levels will be developed and the industrial potential of this technology for multi-level discs will be evaluated. The purpose is to propose a technological solution for the extension of the Blu-Ray format from 25 GB to 75-100 GB for high-definition video content distribution. The second super-resolution technology is based on micro-solid immersion lenses (μ-SILs) which enable to reduce a focused laser spot by a factor equal to the refractive index of the μ-SIL. A low-cost manufacturing process will be developed on 200 mm silicon wafers. The resolution of μ-SIL should be further enhanced by using engineered polarization, high index material, plasmonic nanostructures at focus or functionalization with a Super-RENS layer. The performances of high-resolution optical heads including a μ-SIL will be studied in various application fields such as wafer inspection, optical lithography and confocal microscopy.

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**NBR: 224259** **ACRONYM: SUBTUNE** **EC FUND: 2787695**

**DG:** CNECT **Call: FP7-ICT-2007-2** **Thema:** ICT-2007.3.5

**Title:** Widely Tunable VCSEL using Sub Wavelength Gratings

**Abstract:** Wavelength-tunable lasers are key components for future reconfigurable optical networks and for cost-effective and compact telecommunication infrastructures. Moreover, a broadband and continuously tunable laser with high purity emission spectrum is a versatile tool for many sensing applications, e.g. for greenhouse gases (laser absorption spectroscopy) or deformations of buildings (fiber Bragg grating sensors). A novel concept for widely and continuously wavelength-tunable single-mode laser diodes in the 750-2100 nm wavelength range will be developed. The underlying VCSEL structure is completed by a micro-machined moveable Bragg-mirror with a sub-wavelength grating (SWG). The single-mode property of the VCSEL structure is thus ideally combined with the polarization stability of the SWG and the wide and continuous tunability of the electro-thermally or electro-statically actuated mirror. For the fabrication of the nano-scale SWGs an electron-beam writing process will be developed. The curvature of the micro-mirror will be matched to the phase front of the fundamental mode to achieve its maximum support while suppressing undesired polarization modes by means of a SWG. This technology can select the single fundamental mode from relatively large apertures. The optical output power will be high

and a very good sidemode suppression will be achieved during tuning. The project will develop both long wavelength InP-based VCSELs (1.3µm to 2.1µm) and short wavelength GaAs VCSELs (down to 800nm), and thus introduces widely tunable VCSELs in a broad range of the optical spectrum. Additionally, a technology for integrated tunable VCSELs with dielectric Bragg mirrors will be developed for efficient manufacturing of the laser modules. The devices will be optimized in close cooperation between the university and industrial partners. Devices for gas detection, fiber Bragg grating sensing and optical communications will be investigated.

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**NBR: 224338** **ACRONYM: FAST-DOT** **EC FUND: 10100000**

**DG:** CNECT **Call: FP7-ICT-2007-2** **Thema:** ICT-2007.3.5

**Title:** COMPACT ULTRAFAST LASER SOURCES BASED ON NOVEL QUANTUM DOT STRUCTURES

**Abstract:** FAST-DOT aims to implement a new range of ultrafast quantum-dot lasers for critical bio-medical applications. This project will develop portable, low-cost, reliable, highly efficient ultrashort pulse and ultra-broadband tuneable laser sources. The key technical innovation – quantum dots (QDs) - are based on novel semiconductor nanostructure clusters which demonstrate remarkable new photonic properties. QD structures will afford major advances in ultrafast science and technology by exploiting the unique combination of QD properties (high optical quality, efficient light generation, ultrafast carrier dynamics and broadband gain bandwidth) at wavelength range which not easily accessible with current technologies. The FAST-DOT consortium brings together a unique and compelling group of world-leaders in the physics of QDs and QD photonic devices, system integrators and biophotonic. This research will realise a full understanding of the underlying ultrafast properties and physics of QD structures and exploit these effects in the construction of novel highly compact, reliable and environmentally-stable sources of ultra-short pulses. The new QD sources will be investigated and validated in a range of bio-photonic applications including OCT; Non-linear Microscopy; Nanosurgery and minimally invasive diagnostics. The availability of compact and inexpensive ultrashort pulse lasers will have widespread impact in uptake by making many applications more affordable and opening up new application areas. The project unites 18 complementary European research groups and companies with international reputations in the development of semiconductor materials and their use in efficient ultra-fast lasers, related applications and marketing. All of the groups have record of collaboration and a strong record in producing high quality results and joint publications. This programme will contribute to further extending Europe's world-leading position of in photonics and ultrafast technology.

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**NBR: 224356** **ACRONYM: OPTHER** **EC FUND: 2449847**

**DG:** CNECT **Call: FP7-ICT-2007-2** **Thema:** ICT-2007.3.5

**Title:** Optically Driven Terahertz Amplifiers

**Abstract:** This proposal focuses on the development of an application-specific component that works in the Terahertz (THz) regime; in this context, we propose to realize a THz source with innovative features specific for monitoring systems for safety and security. Until now the use of THz monitoring system has been strongly limited due to the very low power and the large dimensions of the existing sources in the THz.The OPTHER project aims at solving this limitation with a breakthrough with respect to all the other solutions up to know available in Europe, U.S. and Asia. We plan to use available optical THz sources (such as Quantum Cascade Lasers (QCL) or photomixing systems) and boost their performances by designing and fabricating compact, efficient and reliable novel vacuum THz amplifier. The breakthrough of this proposal is the enhancement of the performance of THz optical source by using vacuum THz amplifiers purposely designed and integrated with the optical driver. The novel THz amplifier will be based on field emitting carbon nanotubes (CNT) used as cold cathodes. Two alternative schemes will be employed for amplification. - In the first one (THz drive signal amplifier) the continuous wave electron beam emitted by the CNT cathode is modulated by the electric field in the interaction structure driven by a THz signal - In the second one (optically modulated beam THz amplifier) the emission of current is driven by the THz signal. With this second scheme the delivery of high power output should be facilitated. The source output signal will be fully characterized using commercial broadband detectors such as Schottky diodes or bolometers. The composition of the consortium has been carefully arranged for including all the expertise necessary for a successful conclusion of the research activity. In fact, the present consortium is composed by 6 partners, with complementary research expertise and background: two universities, a research institute and three industries

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**NBR: 224366** **ACRONYM: DELIGHT** **EC FUND: 3300000**

**DG:** CNECT **Call: FP7-ICT-2007-2** **Thema:** ICT-2007.3.5

**Title:** Development of low-cost technologies for the fabrication of high-performance telecommunication lasers

**Abstract:** The “Development of low-cost technologies for the fabrication of high-performance telecommunication lasers” project has two main objectives: (1) Development of high-performance surface-grating-based DFB/DBR telecommunication lasers (2) Development of ultra-high speed directly modulated lasers (>40 GBit/s) with a simplified multi-section design, which exploit high-order photonic resonances for extending the modulation bandwidth. The project approach is to develop a common technological fabrication

platform for both types of lasers based on surface gratings and other surface micro- and nano-structures. One important advantage in using surface structuring for increasing the performances and functionality of edge-emitting lasers is the elimination of the regrowth stage, which adds to the fabrication cost, affects the laser performances (notably the reliability and the characteristics shift in time) and reduces yield. The surface micro- and nano-structures will be imprinted by the low-cost and high-yield nanoimprint lithography, which will contribute to reducing the fabrication cost. The developed surface-oriented technology will be largely independent on the underlying semiconductor structure and will be applied for the fabrication of InP- and GaAs-based edge-emitting lasers (EELs) working in the 1300 and 1550 nm ranges. Although advanced materials (like dilute nitrides and antimony-containing dilute-nitrides) as well as low-dimensional structures (quantum dots and quantum dashes) will be investigated for developing the active regions of the lasers, the surface-oriented technology will be directly applicable to epitaxial layer structures already developed and tested in regular Fabry-Perot telecommunication EELs. Thus the developed surface-oriented approach will have the unique advantage of enabling the fabrication of higher-performance lasers from already tested and qualified 'legacy' epiwafers.

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**NBR: 224525** **ACRONYM: NEMSIC** **EC FUND: 3899998**

**DG:** CNECT **Call: FP7-ICT-2007-2** **Thema:** ICT-2007.3.6

**Title:** Hybrid Nano-Electro-Mechanical / Integrated Circuit Systems for Sensing and Power Management Applications

**Abstract:** NEMSIC addresses the future intelligent sensor and actuator systems in which solid-state semiconductor micro/nanodevices and micro/nano-mechanical devices are co-integrated for new functionalities and increased performance. The project proposes the exploration and development of low power sensing micro/nanosystems based on Nano-Electro-Mechanical (NEM) structures integrated on a Silicon-On-Insulator (SOI) or Silicon-On-Nothing (SON) technological platform. The applications that drive the technological NEM-based smart system demonstrators are gas (COx, NOx, SOx) and biological sensing (DNA, proteins and other molecules), dedicated to critical environment monitoring and applications in the fields of genetics, pharmacology and drug discovery. NEM technology will be combined with silicon CMOS technology involving novelty and scientific/technical challenges at three levels: (i) system level, addressing the challenge of true nano-micro interfaces, where signals detected by arrays of nanostructures are processed by smartly designed low power CMOS circuitry, (ii) device level, where novel true hybrid NEM-FET devices support new highly sensitive detection scheme and power management via sleep switches and (iii) technology level, where nanotechnology processes (top down processed nanobeams and nanogaps, featuring sub-100nm dimensions) will be developed and combined with advanced functionalization techniques for dedicated sensing that stays compatible with CMOS in

future IC-embedded or post-IC approaches. The reliability of the NEM structures, combined with prospects for 0-level packaging are studied as key challenges for the success of such Nano-electro-mechanical-system-integrated-circuits (NEMSIC). Finally, NEMSIC is expected to provide the end-users with flexible design methodologies based on advanced but well-controlled SOI or SON technology platforms, with predictable performances and associated cost effectiveness.

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**NBR: 224565** **ACRONYM: ARAKNES** **EC FUND: 8100000**

**DG:** CNECT **Call: FP7-ICT-2007-2** **Thema:** ICT-2007.3.6

**Title:** Array of Robots Augmenting the KiNematics of Endoluminal Surgery

**Abstract:** ARAKNES stems from the innovative idea to transfer the technologies of bi-manual laparoscopic surgery to the endoluminal surgical approach, thus further reducing the operative trauma and enhancing the therapeutic outcome of minimally invasive surgical procedures for morbid obesity and gastro-esophageal reflux. The worldwide number of bypass surgeries for obesity is predicted to rise up to 1.3 million by 2015, hence the social and industrial impact of ARAKNES is considerable. In particular, European health-systems can benefit from major reductions in costs and hospitalisation periods, the effects of which translate directly to improvements in the quality of life for many EU citizens. Through SandT excellence in micro-robotics and micro-system technologies, ARAKNES will facilitate the combination of current state-of-the-art and breakthrough innovations focusing on integrated micro-nano-bio-info devices. Specifically ARAKNESS will exploit the convergence of: - established laparoscopic techniques; - over 20 years of clinical experience with robotic and computer assisted surgery; - the maturity of micro-, nano- and bio-technologies; - the trend towards wireless, wearable and swallowable devices. This combination enables the conception of a comprehensive micro-robotic based smart operating system for advanced endoluminal surgery, which will reform established endoluminal techniques. The objectives and impact of ARAKNES are broad and ambitious. Consequently, they require a 4-year European project in the format of an IP managed by a strong and committed Consortium. The ARAKNES Consortium is a unique blend of European pioneers in all the involved disciplines (surgery, robotics, information technologies, micro- and nano-technologies) which have the vision, the commitment and the capabilities to make ARAKNES successful in terms of scientific innovation, industrial demonstrations and, ultimately, clinical application.

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**NBR: 224572** **ACRONYM: PHOTONICROADSME** **EC FUND: 799981**

**DG:** CNECT **Call: FP7-ICT-2007-2** **Thema:** ICT-2007.3.5

**Title:** Development of Advanced Technology Roadmaps in Photonics and Industrial Adaption to SMEs

**Abstract:** In the next ten years scientific developments in the field of nanophotonics as a key driving force in photonics will influence many different industrial branches e.g. automotive and avionics, industrial automation ICT, health and well-being, environment or safety and security. In these industrial sectors many SMEs are involved as traditional suppliers, start-ups or producers of high tech products. In order to remain competitive on these markets, the companies have to integrate these new results and developments in their commercial vision for future products. The project PhotonicRoadSME will develop technology roadmaps roadmaps to identify future RTD strategies for Europe in three domains [related nanophotonic materials / novel photonic devices and components / related key fabrication technologies] comprising the latest high level scientific results. Their functions will be a. to identify trends in research and development and b. to associate them to product and application visions. They will outline, which of them are technically and economically promising or possess high potentials for problem-solving and where potential risks and relevant investigation requirements are assumed or social discussion requirement could prevail. Therefore, four different industrial branches will be analyzed (ICT, health and well-being, environment and safety and security). The validation of the roadmap results will be done by a consensus building process by integrating industrial and scientific experts from Europe and third countries. In a second step these roadmaps will be adapted to the SME industrial culture in order to facilitate the integration of the European photonic RTD results in the different industrial branches. The project involves well-known European research organisations and networks, which are leaders in the domain of photonics, European experts in the development of technology roadmaps and organisations from 5 European countries.

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**NBR: 224582** **ACRONYM: GREENBAT** **EC FUND: 2799319**

**DG:** CNECT **Call: FP7-ICT-2007-2** **Thema:** ICT-2007.3.6

**Title:** GREEN and SAFE thin film BATteries for flexible cost efficient energy storage

**Abstract:** In this project printed thin film batteries (TFBs) are developed, manufactured and integrated as flexible and cost efficient energy storage devices. This kind of energy storage concept has huge potential to be integrated into different low cost large area electronics applications such as smart cards, E-books, tags, large area sensor networks… In order to reduce manufacturing costs of this application field the TFBs fabrication is transferred to a roll to roll mass production process which enables cost efficient and large area processing on new or traditional substrates (plastic, glass, paper..). Thus, new nano materials are integrated as batteries components through conventional printing processes (Flexo/helio and Screen printing) used in the industry. So far printed TFBs

have been studied to be manufactured using commercially available materials. The goal of GREENBAT project is to integrate new generation of advanced smart materials in thin film printable batteries using aqueous formulation to achieve high quality, green, safe and durable power sources. The ultimate goal of this project is to integrate these structures to a single assembly resulting in a flexible energy source processed in one step thus reducing production cost. The effort of the GREENBAT consortium is to create a new technology environmental friendly, safe and durable which enables European Community to be competitive with the Asia products, in order to address the area of low cost power source manufacturing and its utilisation in different applications. The competitiveness of European industry in this new disruptive technology has much more potential than in well established products. The development in GREENBAT project creates synergies and cooperation between micro nano technologies RandD, power sources manufacturers, printing industries and end users.

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**NBR: 224594** **ACRONYM: NANOMA** **EC FUND: 2459941**

**DG:** CNECT **Call: FP7-ICT-2007-2** **Thema:** ICT-2007.3.6

**Title:** Nano-Actuators and Nano-Sensors for Medical Applications

**Abstract:** The NANOMA project aims at proposing novel controlled nanorobotic delivery systems which will be designed to improve the administration of drugs in the treatment and diagnosis of breast cancer. Breast cancer is diagnosed in 1.2 million men and women globally every year and kills 500,000. The NANOMA project proposes a magnetic nanocapsule steering approach that relies on improved gradient coils for Magnetic Resonance Imaging (MRI) systems. MRI systems also provide concentration and tracking information, real-time interventional capabilities and are already widespread in hospitals. It is based on fundamental techniques and methods for the propulsion, navigation and effective targeted delivery of coated ferromagnetic capsules in the cardiovascular system through the induction of force from magnetic gradients generated by a clinical MRI. This proposed NANOMA platform will be a valuable tool to help enhance the efficiency of breast cancer treatments while improving patients recovery time. The project rests on the pillar of six work packages (WPs) , which are further divided into subprojects (SPs). Substantial RandD activities are carried out in WP1-WP4 with the goal to design, model and control the microcapsule. In WP5-WP6 new biocarriers and biosensors made of ferromagnetic particles and special functionalized materials reacting to environmental changes in infected cancer cells are being investigated. As proof-of-concept, an in-vivo breast cancer cell detection platform is realized and evaluated in WP7. WP8 deals with the effective Europe-wide exploitation and dissemination of the project results. Finally, WP9 manages the project. The project consortium gives almost a guarantee for the project's success.

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**NBR: 224786** **ACRONYM: SPINTRANSFER** **EC FUND: 45000**

**DG:** REA **Call: FP7-PEOPLE-2007-2-2-ERG** **Thema:** PEOPLE-2007-2-2.ERG

**Title:** Coherent transport of a single electron spin in semiconducting nanostructures

**Abstract:** Control and manipulation of spins is undoubtly one of the major challenges in nanoelectronics for the next decades. The goal of this ambitious project is to realize coherent transport of a single electron spin in a scalable condensed matter system. Presently, one can achieve extremely high control of an electron spin using semiconductor quantum dots, the elementary brick for spin based quantum computer. In order to manipulate and control spins individually on a large scale one has to be able to transport coherently a single electron spin from one place to another in quantum nanoprocessors. The coherent spin transport is the missing piece to the teleportation protocol and to the non-local interaction between distant qubits. Such an approach will open new possibilities to the field of spin-based quantum information processing and is an essential step towards coherent control of a large number of Q-Bits.

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**NBR: 224801** **ACRONYM: SMENATECH** **EC FUND: 45000**

**DG:** REA **Call: FP7-PEOPLE-2007-2-2-ERG** **Thema:** PEOPLE-2007-2-2.ERG

**Title:** Strategic Management of Emergent Nanotechnologies

**Abstract:** The proposed research programme sets out to investigate the multi-faceted nature of the management and development of emerging nanotechnologies through the integration of a variety of conceptual perspectives as well as different levels of analysis. It responds to the declared need for there to be a better understanding of the changing role of knowledge and technology in the creation of a competitive Europe. Advances in nanoscience and nanotechnology create such system of emerging technology innovation where the agents strive to reconcile the potential benefits of radical technological, economic and social change together with their associated uncertainty, ambiguity and instability. Emergence of nanotechnology represents a significant opportunity for researchers to investigate how different agents develop dynamic capabilities and create new business models. This proposal will enable the study of how individual agents engage with the strategic and wider social and economic context in order to explore opportunities offered by nanotechnology. It also offers an ideal setting to study the collaborative nature of emergent technology innovation more generally. Although this project is rooted in the social sciences it requires for serious attention to be paid to the practice of science and technology. This research programme represents the nucleus of a wider research agenda that is taking place at the host institution. This research on the business and managerial aspects of nanotechnology innovation will complement world

class research in the area of nanotechnology. By so doing it will create knowledge relevant to scientists, engineers, entrepreneurs, managers and research policy makers. The project also supports the ambition of the applicant to continue an international career within the European research area and as such embody the ideals of the Marie Curie programme.

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**NBR: 224823** **ACRONYM: ERG-LIGHT** **EC FUND: 45000**

**DG:** REA **Call: FP7-PEOPLE-2007-2-2-ERG** **Thema:** PEOPLE-2007-2-2.ERG

**Title:** Multi-Chromophore Systems for Light Induced Processes and Light Triggered Devices

**Abstract:** The general aim of this project is to gain new knowledge and a deeper understanding of novel two- and three-dimensional nanometer-sized assemblies of chromophores in terms of construction, characterization, photoinduced or electro-optical properties, molecular recognition and selective catalysis, antiviral and anticancer properties. The specific aim of this project is the construction, via a supramolecular approach, of novel photoactive multi-chromophore assemblies. The supramolecular synthetic strategy, by virtue of its modular and highly flexible nature, will allow to perform the selective variation of the components and investigate their influence on the properties of the final assemblies, while keeping at a minimum the synthetic effort. The ultimate aim of this project is the preparation of new photoactive nanosystems to be used in technological applications. The project will be developed within an extended frame of scientific national and international collaborative networks.

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**NBR: 224831** **ACRONYM: QUANTUMBIOLOGY** **EC FUND: 45000**

**DG:** REA **Call: FP7-PEOPLE-2007-2-2-ERG** **Thema:** PEOPLE-2007-2-2.ERG

**Title:** DNA Replication and Biomolecular Recognition

**Abstract:** DNA replication is at the core of life and strongly appeals to the imagination. It is also a textbook example of template directed synthesis, involving enzyme-assisted molecular recognition of incoming bases by the template strand. Yet, in spite of much effort, many fundamental questions about its mechanism are open. In this research line, using a quantumchemical approach, we aim at two main objectives: (1) understanding the electronic nature of molecular recognition in DNA base pairs, in artificial mimics thereof and in larger, macromolecular aggregates of related systems; (2) unravelling the mechanism of the highly accurate, enzyme-assisted DNA replication and, in particular, understanding the role of hydrogen bonding, steric factors and solvent effects in this multistep process. The two subprojects are intimately connected and reinforce each

other. We wish to explore the possibilities of rationally designing monomers whose capability to undergo self-organization can be switched on or off chemically (by a third agent) or physically (by radiation). Potential applications are the controlled and selective formation of macromolecules, nanostructures and materials. Furthermore, a better knowledge and so tuning and control of the DNA replication process is envisaged. On the long term, we hope to contribute to the development in general of quantumchemical approaches to biologically relevant problems, i.e., quantumbiology. Our computations are mostly based on density functional theory (DFT) but also on high-level ab initio theory as well as molecular mechanics (MM). Extensive validation studies, by others and us, have shown that DFT is the method of choice, both in terms of efficiency and accuracy, for large biochemically relevant molecules that involve hydrogen bonding. Our approach furthermore involves the application and further development of hybrid QM/MM techniques for tackling realistic model systems of the template–primer–enzyme complex involved in replication.

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**NBR: 224834** **ACRONYM: LUBRIJOINT** **EC FUND: 45000**

**DG:** REA **Call: FP7-PEOPLE-2007-2-2-ERG** **Thema:** PEOPLE-2007-2-2.ERG

**Title:** Molecular Mechanism of Synovial Joint Lubrication

**Abstract:** This application is concerned with the study of the molecular basis of skeletal joint lubrication in order to improve the design of artificial joint prostheses. These joints eventually fail mainly because of problems associated with inadequate lubrication and revision surgery is an increasingly expensive burden as the population ages. A better understating of such processes should lead to better strategies for minimizing lubrication breakdown in natural joints, as well as to strategies for improving lubrication and wear of prosthetic joint implants and other biological surfaces where prevention of adhesion is required. This proposal seeks to investigate the molecular basis of the remarkably efficient lubrication in mammalian synovial joints, by constructing surfaces partly analogous in structure to that of articular cartilage and measuring forces between them under strictly controlled conditions. Using a surface force balance apparatus, we intend to measure the normal and friction forces between layers of (i) negatively charged hyaluronic acid (HA)-aggrecan (ii) lubricin and HA-aggrecan and (iii) HA-aggrecan and phosphatidylcholine-based phospholipids (PL). Firstly, a pre-biotynilated HA will be attached to mica surface via streptavidin. Aggrecan, extracted from mammalian cartilage, will be added to the HA-coated mica to form supramolecular aggregates similar to those at the cartilage/synovium interface. Secondly, a well-characterized lubricin layers and in a later stage fluorescent or radio-labeled PL will be adsorbed onto the HA-aggrecan mica surface and the interactions studied. Our ultimate goal is to address the interactions between lubricin, PL and HA – the main players in synovial lubrication. At each stage of the project, mica-attached layers will be characterized using AFM, X-ray photoelectron spectroscopy and SFB, and their

tribological properties will be examined, on a nanometer scale, in a wide range relevant to physiological conditions.

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**NBR: 224880** **ACRONYM: CP-SMARTSURFACES** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2007-4-3-IRG** **Thema:** PEOPLE-2007-4-3.IRG

**Title:** Towards better point of care devices: Conducting polymers as smart surfaces in biosensors.

**Abstract:** Discovered just over 20 years ago, conducting polymers (CPs) have gained considerable attention because of their unique chemical and electronic conducting properties. As a result they have various (bio)analytical and technological applications. CPs are easily synthesised, both chemically and electrochemically under mild conditions, opening up vast possibilities for the immobilisation of biomolecules. Immobilisation of antibodies by entrapment within films or by covalent binding on these films permits the straightforward fabrication of biosensors. In electrochemical biosensors, non-specific binding (NSB) of molecules, e.g. proteins in serum, can occur, lowering overall device performance. In the past, surface chemistry has been employed to prohibit NSB on electrodes with sites that do not have antibodies attached. This surface chemistry however, impairs device performance. CPs have inherent dynamic surface properties that can be easily switched upon the application of an appropriate electrical potential. Their ability to be switched between different oxidation states and the associated switch in properties such as doping level, resistance and surface wettability can be controlled by changing the electrical potential resulting in reversible switching. Routes to nano-dimensional CPs, exhibiting markedly improved properties from those of the bulk materials, have been recently developed. We therefore propose to exploit the dynamic chemical nature of CPs to inhibit NSB in electrochemical bio-assays and demonstrate the efficacy of this approach using a simple nanostructured electrochemical prostate cancer diagnostic platform made from conducting polymers. One can imagine the significance of a biosensor that provides increases in performance and shorter detection times, since the immobilising platform, transducer and dynamic surface control are implemented within a single material.

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**NBR: 224924** **ACRONYM: MAPACOMAS** **EC FUND: 75000**

**DG:** REA **Call: FP7-PEOPLE-2007-4-3-IRG** **Thema:** PEOPLE-2007-4-3.IRG

**Title:** Materials analysis based on partially correlated magnetic switching

**Abstract:** Nowadays, practically all high-capacity information storage is based on hard disk drive (HDD) technology, which utilizes magnetic materials as a recording media on rotating disk platters. Presently, the HDD industry is undergoing a major technology transformation towards perpendicular magnetic recording (PMR), in which the 'magnetic bits' are aligned perpendicularly to the disk surface. Many aspects of PMR technology, however, are only poorly understood at the present time. Specifically, there exists a severe lack of accurate characterization methods for recording media. As a consequence, the optimization process to take full advantage of PMR technology is far from being achieved today. The present proposal for an international reintegration grant for Dr. Hovorka (Drexel University, USA) is aimed at developing an accurate characterization technique for PMR media based upon a quantitatively exact analysis of their complex magnetization behavior. The challenge is to understand the physics of partially correlated reversal, which is mediated by the sufficiently strong grain-to-grain interactions. The project will build on realistic microscopic modeling for numerical and analytic method development to derive quantitatively accurate analysis schemes of magnetization reversal as the foundation for reliable characterization methods of PMR media. The main goals of this proposal are: (a) to establish Dr. Hovorka's reintegration into the European research community while allowing him to reach a high level of professional maturity for the overall benefit of the European knowledge society, (b) to expand Dr. Hovorka´s solid basic research expertise in nano-magnetism by adding technology-oriented competencies at an advanced level, and (c) to allow nanoGUNE, the host institution, to complement its expertise in such a way that it can maintain and even extend its world-wide leadership position in PMR materials characterization.

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**NBR: 224925** **ACRONYM: BIOSCA** **EC FUND: 45000**

**DG:** REA **Call: FP7-PEOPLE-2007-2-2-ERG** **Thema:** PEOPLE-2007-2-2.ERG

**Title:** Intelligent and reinforced tissue scaffolds for regenerative biomedicine

**Abstract:** Calcium phosphate ceramics have been used in medicine for more than 20 years because of its similarities to bone apatite. Bone repair and regeneration occurs along its surface and porous structures permits bone ingrowths acting as a scaffold in bony tissues sites. As well as these ceramics, bioactive glasses and biocompatible polymers are widely used but all of them present low strength and poor fatigue resistance to be implanted as high load bearing devices. In order to seek better ways of processing biomaterials, so that both mechanical properties and porosity could be optimized, devices have been design combining HA with other materials, however, significant amounts of the reinforcing phases are needed to achieve the desired properties, and as these parts are significantly less bioactive than HA, or bioreabsorble, the ability of the composite to form a stable interface is poor compared to HA itself. An ideal reinforcement material would impart mechanical integrity without diminishing its properties. This project envisages the use of carbon nanotubes (CNTs) as reinforcement

material for the bioactive ceramics and to use their ability as drug delivery systems of pharmacological active molecules (osteogenic, antitumoral, antiviric,…) or as smart materials (able to change their properties as a function of the medium). In relation to this, the addition of CNTs to the base composite produces a three-dimensional electrical conducting network, property as has already been reported, could be used to provide electrical stimulation and increase of cellular proliferation.

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**NBR: 224929** **ACRONYM: PE-NANOCOMPLEXES** **EC FUND: 45000**

**DG:** REA **Call: FP7-PEOPLE-2007-2-2-ERG** **Thema:** PEOPLE-2007-2-2.ERG

**Title:** Polyelectrolyte nanocomplexes

**Abstract:** The major goal of the proposed project is to facilitate the applicant's reintegration to his home institute after a successful Marie Curie training period at the Surface Chemistry, Dept. of Chemistry, KTH, Stockholm. To reach this goal the host (Eötvös Lorand University, Budapest) offers a permanent position for him and provides the infrastructure necessary to implement the proposed research project. The proposed research project consists of two independent work packages. The first work package aims at developing and applying a nanoprobe technique to determine the optimal structure of DNA-polyelectrolyte complexes, which is an important step required to increase the efficiency of current non-viral gene delivery systems. The second work package will map the effect of multivalent ions on the interaction of a flexible polyelectrolyte and an oppositely charged surfactant, which will provide information how the strong ion-ion correlations, introduced by the multivalent ions, affect surfactant/polyelectrolyte self-assembly. Finally, the reintegration grant will allow the researcher to transfer his new competences (related to modern surface characterization techniques, e.g. DPI, AFM, QCM-D, ellipsometry) to the host institution of the reintegration period and to the wider audience of its students.

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**NBR: 224933** **ACRONYM: ATTOSECOND OPTICS** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2007-4-3-IRG** **Thema:** PEOPLE-2007-4-3.IRG

**Title:** Harnessing attosecond nonlinear optics for controlling and enhancing high harmonic generation and producing useful coherent x-rays on a tabletop

**Abstract:** Attosecond nonlinear optics will be harnessed for increasing the efficiency and tunability of laser-driven x-rays through high harmonics generation. The process of high harmonic generation, which converts visible laser light into laser-like x-rays, facilitates new directions in science and technology. Examples include the production of attosecond

pulses of light that allows direct investigation of the motions of electrons in atoms, molecules, and materials as well as the compact generation of x-rays for nano and bio imaging. However, for most applications, the generation of usable flux is, to date, limited to relatively long wavelengths (>10 nm) in which the upconversion process is rather benign and can be fully phase matched. At the foundation of this proposal are all-optical quasi-phase matching techniques, recently pioneered by the author during his post-doc in USA, which allows the holographic creation of nonlinear structures in the high harmonic generation process. Similarly to photonic structures for visible light, the optically induced nonlinear structures can be used for manipulating and enhancing the generated x-rays. New quasi-phase matching techniques will be developed and implemented for generating harmonics at 10-1 nm with high flux. Periodic structure with periodicity that varies according to the phase matching conditions of a given harmonic order will be used for generating coherent quasi-monochromatic x-rays while stochastic structures will be exploited for generating wideband x-rays. Longitudinally chirped periodic structures will be used for generating sub 100 attosecond pulses while transversely parabolic periodic structures will be exploited for focusing the generated beam at a required distance from the nonlinear medium. The proposed research will have important impact on the generation of compact and bright coherent x-rays for applications in materials and chemical dynamics, nanotechnology, microscopy, biology, and medicine.

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**NBR: 224944** **ACRONYM: EMSWIM** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2007-4-3-IRG** **Thema:** PEOPLE-2007-4-3.IRG

**Title:** Electromagnetic and spin wave interactions in magnetic nanostructure-based metamaterials and devices

**Abstract:** The proposal is focused on the fundamental and applied research of electromagnetic and spin wave processes in laterally patterned periodic nanostructures and derived metamaterials and devices, with particular interest in magnetic materials. The research aims at the development and computer implementation of a theoretical approach capable of modeling the electromagnetic response of the nanostructures, their numerical and experimental investigation, proposing and designing novel applications, and studying related physical phenomena such as photon-spin wave interactions. Graphical, user-friendly software based on the numerical algorithm will be utilized for a commercial scatterometric system in the frame of international collaboration with Dainippon Screen Mfg. Co. Ltd., Japan. The project will use magneto-optical spectroscopy available at the host institution and other optical, magneto-optical, and complementary magnetism- and surface-science techniques provided by collaborating laboratories in the Czech Republic, Germany, and Japan. The results obtained on the nanostructures will be used to propose and design novel artificial metamaterials (such

as magneto-photonic crystals) and devices (such as waveguides, microcavities, polarizing, space-modulating and other optical filters).

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**NBR: 225187** **ACRONYM: NAME-QUAM** **EC FUND: 2440755**

**DG:** CNECT **Call: FP7-ICT-2007-C** **Thema:** ICT-2007.8.0

**Title:** Nanodesigning of Atomic and MolEcular QUAntum Matter

**Abstract:** The Project investigates ultracold atom/molecule quantum matter technology for quantum information computational tasks. Our efforts concentrate on atoms/molecules confined in periodic nanostructures, either externally imposed by optical lattices, or self-generated by atomic/molecular interactions. Parallel quantum processing in periodic nanostructures is expected to lead to significant advances in different areas of quantum information. The Project aims at developing novel techniques for quantum engineering and quantum control of ultracold atoms and molecules confined in the periodic nanostructures. An innovative aspect is the development of appropriate tools for achieving quantum control of strongly correlated many body systems at the nanoscale by exploiting moderate- and long-range quantum mechanical interactions. Strongly correlated interacting systems offer a level of computational power that cannot be reached with traditional qubits based on spin, or hyperfine atomic states. Moderate and long, range interactions will be exploited in few body quantum systems in order to produce fast quantum gates using novel robust qubit and/or qudit concepts and using quantum states with topological order, all of them highly relevant for next generation quantum information implementations. The objectives rely on the nanodesign of atomic/molecular quantum matter at the mesoscopic scale of few-body systems. Generation and detection of multiparticle quantum entanglement, robusteness of non-traditional qubits, quantum memories characterise our investigation. The Project will implement new quantum information technologies by achieving the following breakthroughs: characterizing long range interacting systems for optimal quantum information; realizing individual manipulation integrated in proper algorithms; designing new protected qubits or quantum information processors based on long range interactions; developing techniques for topological quantum computation; creating multi-partimulti-particle entanglement for quantum simulation investigations. At the present stage of the quantum information development our objectives are unique for the optical lattice quantum matter technology. As far as the visionary aspects are concerned, the technological and conceptual advances resulting from the planned investigations on multiparticle entanglement, topological structures and nano-optical engineering may lead to the identification of new directions and alternative approaches towards scalable and miniaturisable quantum information processing.

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**NBR: 225955** **ACRONYM: STELE** **EC FUND: 1741000**

**DG:** CNECT **Call: FP7-ICT-2007-C** **Thema:** ICT-2007.8.0

**Title:** Spin-Thermo-Electronics

**Abstract:** New magneto-transport phenomena have been discovered in magnetic multilayers and are now being optimized for industrial applications, extending the conventional electronics with new functionality. However, most of the current research on magnetic multilayer materials and its device applications rely on conventional equilibrium electron transport. The full potential of nano-structuring, which leads to a broad spectrum of novel non-equilibrium transport phenomena, is therefore not realized. In this research project we will focus on practically unexplored functional principles that can be implemented in nanostructures produced by state-of-the-art lithography and surface manipulation techniques. Our main idea is to use electrically controlled spin currents in highly non-equilibrium regimes with respect to energy and temperature; hence "spin-thermo-electronics". The large amount of heat generated in nanoscale devices is today one of the most fundamental obstacles for reducing the size of electronics. In this proposal we turn the problem around by instead using electrically controlled local heating of magnetic nano-circuits to achieve fundamentally new functionality, relevant to several key objectives of the information and communication technology. Particular emphasis will be put on investigating and technologically evaluating the interplay of spin, charge, and heat in magnetic structures of sub-10 nm dimensions. Such structures, although inaccessible by today's lithographic means, are in our view crucial for further miniaturization of electronic devices.

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**NBR: 226043** **ACRONYM: HOWTOCONTROLGRAPHENE** **EC FUND: 1563800**

**DG:** ERCEA **Call: ERC-2008-AdG** **Thema:** ERC-AG-PE3

**Title:** Search for mechanisms to control massless electrons in graphene

**Abstract:** Conduction electrons in the carbon monolayer known as graphene have zero effective mass. This property offers unique opportunities for fast electronics, if we can somehow learn to control the dynamics of particles which have a charge but no mass. Fresh ideas are needed for this purpose, since an electric field is incapable of stopping a massless electron (its velocity being energy independent). The applicant and his group at the Lorentz Institute for Theoretical Physics in Leiden University have started exploring the new physics of graphene soon after the announcement two years ago of the discovery of massless electrons in this material. We have identified several promising control mechanisms, and are now ready to embark on a systematic search. Our objective is to discover ways to manipulate in a controlled manner three independent electronic

degrees of freedom: charge, spin, and valley. The charge is the primary carrier of classical information, being strongly coupled to the environment, while the spin is the primary carrier of quantum information, in view of its weak coupling to the environment. The valley degree of freedom (which defines the chirality of the massless particles) is intermediate between charge and spin with regard to the coupling to the environment, and provides some unique opportunities for control. In particular, we have the idea that by acting on the valley rather than on the charge it would be possible to fully block the electronic current (something which an electric field by itself is incapable of). To study these effects we will need to develop new methodologies, since the established methods to model quantum transport in nanostructures are unsuitable for massless carriers.

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**NBR: 226180** **ACRONYM: FURORE** **EC FUND: 2049600**

**DG:** ERCEA **Call: ERC-2008-AdG** **Thema:** ERC-AG-PE3

**Title:** FUndamental studies and innovative appROaches of REsearch on magnetism

**Abstract:** Based on our developments of Spin-Polarized Scanning Tunnelling Microscopy (SP-STM) and Magnetic Exchange Force Microscopy (MExFM), both offering spin sensitivity and spatial resolution down to the ultimate limit of single atoms, we will study spin-dependent interactions between individual magnetic atoms on metal surfaces, in diluted magnetic semiconductors, on surfaces of magnetic insulators, as well as between single-atom tips and ultracold quantum gases. Besides the investigation of static spin states and spin interactions, we will manipulate spin states in a controlled manner down to the single atom limit by making use of the spin-transfer torque exerted by spin-currents from an atomically sharp SP-STM tip across a vacuum barrier. Moreover, we will combine spin-current induced magnetization switching experiments on magnetic metallic nanostructures based on SP-STM with pump-probe experiments, thereby studying the fundamentals of magnetization reversal processes both spatially and time-resolved. We will make use of the powerful combination of SP-STM with single-atom manipulation to probe spin-dependent interactions in artificial nanostructures. In the case of magnetic insulators we will probe spin states and spin-dependent interactions based on local measurements of the quantum-mechanical exchange and correlation forces between a single-atom tip with a well-defined spin state and single atoms of the sample. Spin excitations at the level of individual atoms will be probed by a combination of SP-STM with inelastic electron tunnelling spectroscopy, while the combination of MExFM with measurements of the damping of the cantilever oscillation will be employed to reveal local spin excitations in electrically insulating materials. Finally, we will couple an MExFM-type force sensor to the spin state of an optically trapped ultracold quantum gas with the challenging goal to combine scanning probe and quantum optical methods for manipulating quantum states of matter.

**NBR: 226187** **ACRONYM: SOCATHES** **EC FUND: 2344800**

**DG:** ERCEA **Call: ERC-2008-AdG** **Thema:** ERC-AG-PE3

**Title:** Solid State/Cold Atom Hybrid Quantum Devices

**Abstract:** Solid state physics and atomic physics have developed in a way that the combination of the two fields will produce massive synergetic effects and new physics. Thin film structures can be patterned and controlled down to the atomic level. Mesoscopic structures are used to create well defined two level systems and are presently explored in terms of their capability of being the basis of a quantum computer. The quantum dynamics of single electrons on a quantum dot or single Cooper pairs or flux quanta in case of superconductors can be controlled very well at temperatures in the Millikelvin range. Complementary, atomic physics has learned to control atoms and molecules almost perfectly and has turned to large ensembles of cold atoms forming e. g. Bose Einstein Condensates at low temperatures. In the present proposal we aim on the realization of such coupled solid state - atomic objects, starting with superconducting structures on the solid state side and with Rubidium atoms on the quantum optics side. We plan to investigate their fundamental properties and explore possible applications. In a second stage we consider including mechanical systems - nanoresonators - into our investigations. The heart of the experiments will be a ultra high vacuum millikelvin environment realized by a properly designed 3He-4He dilution refrigerator combined with a cold atom/BEC system. In terms of fundamental physics we will investigate the quantum nature of systems consisting of a macroscopic object like a flux quantum coherently coupled to a microscopic object like an atom. Combining solid state devices with atoms could lead to novel architectures in the field of quantum devices. In a similar spirit, ultrasensitive solid state detectors could be combined with atomic detection schemes, allowing for novel high precision measurement systems. We thus envision enormous potential for precision measurements and quantum engineered devices.

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**NBR: 226207** **ACRONYM: PATCHYCOLLOIDS** **EC FUND: 1559159**

**DG:** ERCEA **Call: ERC-2008-AdG** **Thema:** ERC-AG-PE3

**Title:** Patchy colloidal particles: a powerful arsenal for the fabrication of tomorrow new super-molecules . A theoretical and numerical study of their assembly processes.

**Abstract:** An unprecedented development in particle synthesis is providing methods to generate high yield quantities of nano- and micro-particles of different shapes, compositions, patterns and functionalities and an unprecedented diverse spectrum of particle

patchiness, significantly extending the naturally available choices. These methods draw from the diverse fields of chemistry, physics, biology, engineering and materials science, and, in combination, provide a powerful arsenal for the fabrication of new particulate building blocks, the molecules of tomorrow materials, self-assembling into molecular-mimetic and unique structures, fluids, and gels made possible solely by their design. The new particles offer the possibility to go beyond the spherical interaction case, to move from the colloidal atom to the colloidal molecule --- providing valence to colloids --- and to further strength the analogies between colloids and globular proteins. The present theoretical and computational project aims at providing new ideas for developing effective methodologies of bottom-up manufacturing, at providing the scientific community with the background necessary to fully control the self-assembly of these new building blocks as well as solutions to relevant condensed-matter physics problems. The project also aims at developing realistic models of DNA-functionalized nano and micro particles, presently the most promising and versatile building block of bio-colloid materials. Understanding the assembly of patchy particles will offer fine control over the three-dimensional organization of materials, as well as the combination of different materials over several length scales, making it possible to design a spectrum of crystal polymorphs and self-assembled ordered and disordered structures unprecedented in colloid science.

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**NBR: 226238** **ACRONYM: MMFCS** **EC FUND: 1320000**

**DG:** ERCEA **Call: ERC-2008-AdG** **Thema:** ERC-AG-PE8

**Title:** Multiscale Models for Catalytic-Reaction-Coupled Transport Phenomena in Fuel Cells

**Abstract:** In proton exchange membrane fuel cells (PEMFCs) and solid oxide fuel cells (SOFCs) there are various transport processes strongly affected by catalytic chemical/electrochemical reactions in nano- or/and micro-structured and multi-functional porous electrodes. Due to the complexity of fuel cells, fundamental understanding of physical phenomena continues to be required for the coupled chemical and transport processes with two-phase flow/water management in PEMFCs, and internal reforming reactions/thermal management in SOFCs. The project deals with the coupling of micro scale reactions (such as the electrochemical reactions and catalytic reactions) with various transport phenomena to provide a comprehensive understanding of fuel cell dynamics. The methodology for the project is a combination of model development and integration, simulation/analysis and validation. For microscopically complex porous layers and active sites, submodels will be developed by considering the detailed elementary kinetic rates based on the intermediate chemical species and their reactions occurring on the surface of the involved materials. As the inputs, the obtained data from the microscopic submodels will be implemented by the macroscopic CFD codes, previously developed for various applications, to examine local parameters in the porous electrodes and components. Both macro- and microscopic

models will be validated by the experimental and/or literature data during the course of the project. The project will make progress beyond the state-of-the-art in modelling and analysis of advanced fuel cells, such as ultra low Pt loading (

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**NBR: 226246** **ACRONYM: NANOSQUID** **EC FUND: 2000000**

**DG:** ERCEA **Call: ERC-2008-AdG** **Thema:** ERC-AG-PE3

**Title:** Scanning Nano-SQUID on a Tip

**Abstract:** At the boundaries of physics research it is constantly necessary to introduce new tools and methods to expand the horizons and address fundamental issues. In this proposal, we will develop and then apply radically new tools that will enable groundbreaking progress in the field of vortex matter in superconductors and will be of great importance to condensed matter physics and nanoscience. We propose a new scanning magnetic imaging method based on self-aligned fabrication of Josephson junctions with characteristic sizes of 10 nm and superconducting quantum interference devices (SQUID) with typical diameter of 100 nm on the end of a pulled quartz tip. Such nano-SQUID on a tip will provide high-sensitivity high-bandwidth mapping of static and dynamic magnetic fields on nanometer scale that is significantly beyond the state of the art. We will develop a new washboard frequency dynamic microscopy for imaging of site-dependent vortex velocities over a remarkable range of over six orders of magnitude in velocity that is expected to reveal the most interesting dynamic phenomena in vortex mater that could not be investigated so far. Our study will provide a novel bottom-up comprehension of microscopic vortex dynamics from single vortex up to numerous predicted dynamic phase transitions, including disorder-dependent depinning processes, plastic deformations, channel flow, metastabilities and memory effects, moving smectic, moving Bragg glass, and dynamic melting. We will also develop a hybrid technology that combines a single electron transistor with nano-SQUID which will provide an unprecedented simultaneous nanoscale imaging of magnetic and electric fields. Using these tools we will carry out innovative studies of additional nano-systems and exciting quantum phenomena, including quantum tunneling in molecular magnets, spin injection and magnetic domain wall dynamics, vortex charge, unconventional superconductivity, and coexistence of superconductivity and ferromagnetism.

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**NBR: 226338** **ACRONYM: ELAB4LIFE** **EC FUND: 2382442**

**DG:** ERCEA **Call: ERC-2008-AdG** **Thema:** ERC-AG-PE7

**Title:** eLab4Life: Electr(ochem)ical Labs-on-a-Chip for Life Sciences

**Abstract:** We propose the development of new electrochemical techniques for health and life sciences applications in Lab-on-a-Chip devices. A Scanning ElectroChemical Microscope (SECM) will be used to study surface properties, such as local consumption and/or release of electroactive chemical compounds by (single) cells by electrochemical sensing, new detection methods for proteins using redox cycling, and new separation methods for DNA exploiting nanoscale electrical field gradients. The ability to generate and control electrical fields (and gradients) at the scale of the size of biomolecules using nanostructures, and the simple translation of novel electrical methods into practical Lab-on-a-Chip devices will create a breakthrough in bioanalytical methods. The knowledge and expertise obtained from SECM experimentation will be used to design and realize Labs-on-a-Chip that can be used for efficient production of drugs by electrofused cells, for early biomarker detection using nanowires and nano-spaced electrodes (Point-of-Care application), and rapid DNA analysis using nanofluidic structures. Besides this, the results can have great benefits for study of embryonic cell growth and for advanced tissue engineering. The results will be translated into devices and systems that can be used in Point-of-Care (POC) applications and will bring this area a big step closer to successful commercialization.

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**NBR: 226347** **ACRONYM: MONACAT** **EC FUND: 1950097**

**DG:** RTD **Call: FP7-ENV-NMP-2008-2** **Thema:** ENV.2008.3.1.1.2.

**Title:** Monolithic reactors structured at the nano and micro levels for catalytic water purification

**Abstract:** This project aims at the preparation and testing of catalyst supported on structured reactors (ceramic and metallic honeycomb monoliths, metallic filters, carbon cloth) coated with nanocarbon materials (NCM), namely carbon nanofibers (CNF) and carbon nanotubes (CNT). This structured catalytic reactor will be used for catalytic water purification. Every partner responsible for testing the monoliths will focus on a different pollutant (Nitrates, organic matter…) and catalytic process (hydrogenation, oxidation) depending on the particular expertise of every partner. The properties of monolithic reactor coated with NCM, e.g. thin catalyst layer and mesoporosity, enable the control of the diffusion path and enhance the diffusion of reactant to catalytic sites. The objective is to achieve, via the use of monoliths coated with NCM, an intensification of the catalytic process in terms of improved selectivity, robustness, stability and performance while reducing energy requirements and by-product generation with respect to the catalytic process using conventional reactors, as e.g. trickled bed or slurry

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**NBR: 226460** **ACRONYM: EUMINAFAB** **EC FUND: 5999868**

**DG:** RTD **Call: FP7-INFRASTRUCTURES-2008-1** **Thema:** INFRA-2008-1.1.1

**Title:** Integrating European research infrastructures for micro-nano fabrication of functional structures and devices out of a knowledge-based multimaterialsâ€™ repertoire

**Abstract:** Micro- and nanotechnologies have the potential to increase economic growth in every geographical area of Europe and among almost every industry leading to new product innovations, new companies and new jobs. Such innovative ideas based on solutions using micro and nano fabrication technologies require access not only to high end equipment but also the essential highly skilled personnel. It is not possible for SME's or even most research departments to justify investment in a comprehensive range of technologies and trained personnel, especially when the need is to try out the feasibility of a new idea or develop a one off tool. EUMINAfab aims to overcome such economic barriers and lack of skills by creating the first pan-European research infrastructure for micro- and nanotechnologies for structuring and characterising a multitude of functional materials. The consortium integrates 9 leading academic institutes and three industrial partners from seven European member states. Five networking and three Joint research work packages create the framework for the transnational access activities which are open for users from both industry and academia from throughout European member and associated states. EUMINAfab opens access to more than 50 installations and offers over 1300 user days of access in the project duration of four years. The budget of nearly 7,79M€ with a requested EC contribution of almost 6M€ is thus dedicated to structuring the ERA in the area of multimaterial micro and nanotechnologies.

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**NBR: 226470** **ACRONYM: SILAMPS** **EC FUND: 1928020**

**DG:** ERCEA **Call: ERC-2008-AdG** **Thema:** ERC-AG-PE7

**Title:** Silicon integrated lasers and optical amplifiers

**Abstract:** This project is a five year programme of work to develop fully integrated optical emitters, lasers and optical amplifiers in silicon. Recent years have seen tremendous advances in the development of silicon photonic devices. However, the last hurdle to full silicon photonic systems and optical data transfer on and between integrated circuits are electrically pumped optical amplifiers and lasers in silicon using a CMOS compatible technology. Consequently, there have been massive efforts worldwide to search for efficient light emission from silicon. Our team made a major initial breakthrough producing the first LED in bulk silicon - published in NATURE (1997). Although a world first, this device only operated efficiently at low temperatures. This problem was solved using a new nanotechnology - dislocation engineering - reported in NATURE (2001) - and crucially uses only conventional CMOS technology. The development of this into a silicon injection laser and optical amplifiers is the essential next step for high technology high value applications. We have recently made a further breakthrough by obtaining

extraordinary optical gain in erbium doped silicon that now offers a realistic route to this goal. Currently the incorporation of lasers and amplifiers on silicon platforms can only be achieved hybridizations of active devices based on III-V materials "pasted" on to silicon waveguides and cavities. Gain has been reported using four-wave-mixing and Intel has recently demonstrated a Raman laser in silicon but both rely on purely optical-to-optical transitions and are fundamentally unable to be electrically pumped. We believe we have the only route that has the potential to produce electrically pumped amplifiers and lasers with room and higher temperature operation and that is capable of genuinely being fully integrated into silicon using standard silicon process technology.

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**NBR: 226524** **ACRONYM: WATERMIM** **EC FUND: 2491334**

**DG:** RTD **Call: FP7-ENV-NMP-2008-2** **Thema:** NMP-2008-1.2-2

**Title:** Water Treatment by Molecularly Imprinted Materials

**Abstract:** The present “WATERMIM” proposal is focused on the advancement and optimization of the MIP technology in order to produce functional materials with well-defined morphologies with respect to pore structure and selectivity for water treatment applications. The project aims at the elimination of the random distribution and the uneven accessibility of receptor sites in the volume of the imprinted material that is crucial for its performance. Such novel materials will immediately gain practical relevance, especially, due to their increased selectivity and superior stability under long and harsh technical conditions. The simultaneous optimization of the imprinting efficiency, polymer membrane morphology and separation conditions will enable the development of a truly molecular selective water purification process, based on affinity interactions that would have a large application impact on the water treatment industry. All types of synthetic organic compounds (i.e., triazines, pharmaceutical compounds and endocrine disruptors) are considered target compounds in the WATERMIM project. More specifically, the present project aims at the following S&T objectives: • Selection of template molecules and synthesis of functional monomers. • Optimization of molecularly imprinted polymer (MIP) composition by computational design techniques and combinatorial screening. • Synthesis of well-defined MIP nanoparticles and microgels. • Production of novel composite membranes utilizing preformed MIP nanoparticles. • Production of composite filters both on organic and inorganic supports via novel grafting techniques. • Synthesis of molecularly imprinted membranes (MIMs) for molecular sensor applications. • Separation and catalytic decomposition of the pollutants. • Advanced monitoring of the target compounds. • Benchmark testing of the produced MIMs for water purification.

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**NBR: 226558** **ACRONYM: MOLNANOSPIN** **EC FUND: 2096703**

**DG:** ERCEA **Call: ERC-2008-AdG** **Thema:** ERC-AG-PE3

**Title:** Molecular spintronics using single-molecule magnets

**Abstract:** A revolution in electronics is in view, with the contemporary evolution of two novel disciplines, spintronics and molecular electronics. A fundamental link between these two fields can be established using molecular magnetic materials and, in particular, single-molecule magnets, which combine the classic macroscale properties of a magnet with the quantum properties of a nanoscale entity. The resulting field, molecular spintronics aims at manipulating spins and charges in electronic devices containing one or more molecules. The main advantage is that the weak spin-orbit and hyperfine interactions in organic molecules suggest that spin-coherence may be preserved over time and distance much longer than in conventional metals or semiconductors. In addition, specific functions (e.g. switchability with light, electric field etc.) could be directly integrated into the molecule. In this context, the project proposes to fabricate, characterize and study molecular devices (molecular spin-transistor, molecular spin-valve and spin filter, molecular double-dot devices, carbon nanotube nano-SQUIDs, etc.) in order to read and manipulate the spin states of the molecule and to perform basic quantum operations. MolNanoSpin is designed to play a role of pathfinder in this still largely unexplored - field. The main target for the coming 5 years concerns fundamental science, but applications in quantum electronics are expected in the long run. The visionary concept of MolNanoSpin is underpinned by worldwide research on molecular magnetism and supramolecular chemistry, the 10-year long experience in molecular magnetism of the PI, his membership in FP6 MAGMANet NoE, and collaboration with outstanding scientists in the close environment of the team. During the last year, the recently founded team of the PI has already demonstrated the first important results in this new research area.

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**NBR: 226563** **ACRONYM: ENFIRO** **EC FUND: 3157554**

**DG:** RTD **Call: FP7-ENV-2008-1** **Thema:** ENV.2008.3.1.4.1.

**Title:** Life Cycle Assessment of Environment-Compatible Flame Retardants ( Prototypical case study)

**Abstract:** Brominated flame retardants (BFRs) will be phased out because of their environmental hazards. Less toxic alternatives appear to be available already but comprehensive information on their possible toxicological effects are lacking. ENFIRO offers a prototypical case study on substitution options for BFRs resulting in a comprehensive dataset on viability of production and application, environmental safety, and a complete life cycle assessment. Dissemination will ensure the project results to arrive at policymakers' desks. The ENFIRO consortium is a unique collaboration between

industries, SME's and universities with a wide variety of scientific disciplines. ENFIRO will contribute to the phasing out of BFRs as proposed in the European Water Framework Directive. The approach and the results of ENFIRO will be useful for similar substitution studies, e.g. in REACH. Following a study on literature and industrial information, and prioritizing , three flame retardant (FR)/product combinations will be selected (e.g. metal-based FRs, phosphorous-based and nanoclay-based FRs in printed circuit boards, paints and foam). These will be studied for environmental and toxicological risks, and for viability of industrial implementation, i.e. production of the FR, fire safety and application of the FR into products (electronics, furniture, paints, foams, etc.). All information from these tests will be used for a risk assessment. The outcome of that assessment will, together with socio-economic information be used in a complete life cycle assessment. The project will follow a pragmatic approach, avoiding final recommendations on environment-compatible substitution options that would not be viable for implementation by industry. A Substitution Information Exchange Forum with members representing FR users (large industries) has been invited to guide this project.

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**NBR: 226593** **ACRONYM: COORDSPACE** **EC FUND: 2492371**

**DG:** ERCEA **Call: ERC-2008-AdG** **Thema:** ERC-AG-PE5

**Title:** Chemistry of Coordination Space: Extraction, Storage, Activation and Catalysis

**Abstract:** The Applicant has an outstanding record of achievement and an international reputation for independent research across many areas of metal coordination chemistry. This high-impact and challenging Proposal brings together innovative ideas in coordination chemistry within a single inter- and multi-disciplinary project to open up new horizons across molecular and biological sciences, materials science and energy research. The Proposal applies coordination chemistry to the key issues of climate change, environmental and chemical sustainability, the Hydrogen Economy, carbon capture and fuel cell technologies, and atom-efficient metal extraction and clean-up. The vision is to bring together complementary areas and new applications of metal coordination chemistry and ligand design within an overarching and fundamental research program addressing: i. nanoscale functionalized framework polymers for the storage and activation of H2, CO2, CO, O2, N2, methane and volatile organic compounds; ii. new catalysts for the reversible oxidation and photochemical production of H2; iii) clean and selective recovery of precious metals (Pt, Pd, Rh, Ir, Hf, Zr) from process streams and ores. These research themes will be consolidated within a single cross-disciplinary and ambitious program focusing on the control of chemistry, reactivity and interactions within self-assembled confined and multi-functionalized space generated by designer porous framework materials. An AdG will afford the impetus and freedom via consolidated funding to undertake fundamental, speculative research with multiple potential big-hits across a wide range of disciplines. Via an extensive network of international academic and industrial collaborations, the Applicant will deliver major

research breakthroughs in these vital areas, and train scientists for the future of Europe in an exciting, stimulating and curiosity-driven environment.

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**NBR: 226639** **ACRONYM: INTIF** **EC FUND: 1618238**

**DG:** ERCEA **Call: ERC-2008-AdG** **Thema:** ERC-AG-PE5

**Title:** Inorganic nanotubes and fullerene-like materials: new synthetic strategies lead to new materials

**Abstract:** Inorganic nanotubes (INT) and particularly inorganic fullerene-like materials (IF) from 2-D layered compounds, which were discovered in the PI laboratory 16 years ago, are now in commercial use as solid lubricants (www.apnano.com) with prospects for numerous applications, also as part of nanocomposites, optical coatings, etc. The present research proposal capitalizes on the leadership role of the PI and recent developments in his laboratory, much of them not yet published. New synthetic approaches will be developed, in particular using the WS2 nanotubes as a template for the growth of new nanotubes. This include, for example PbI2@WS2 or WS2@NbSe2 core-shell nanotubes, which could not be hitherto synthesized. Other physical synthetic approaches like ablation with solar-light, or pulsed laser ablation will be used as well. Nanooctahedra of MoS2 (NbS2), which are probably the smallest IF (hollow cage) structures, will be synthesized, isolated and studied. Extensive ab-initio calculations will be used to predict the structure and properties of the new INT and IF nanoparticles. Cs-corrected transmission electron microscopy will be used to characterize the nanoparticles. In particular, atomic resolution bright field electron tomography will be developed during this study and applied to the characterization of the INT and IF nanoparticles. The optical, electrical and mechanical properties of the newly sythesized INT and IF materials will be investigated in great detail. Devices based on individual nanotubes will be (nano)fabricated and studied for variety of applications, including mechanical and gas sensors, radiation detectors, etc. Low temperature measurements of the transport properties of individual INT and IF will be performed.

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**NBR: 226783** **ACRONYM: INSIDEFOOD** **EC FUND: 2832282**

**DG:** RTD **Call: FP7-KBBE-2008-2B** **Thema:** KBBE-2008-2-3-01

**Title:** Integrated sensing and imaging devices for designing, monitoring and controlling microstructure of foods

**Abstract:** The main S&T objective of InsideFood is to provide technological solutions for sensing the microstructure of foods. The project will develop and combine X-ray nano- and

microtomography, nuclear magnetic resonance spectrocopy, magnetic resonance imaging, optical coherence tomography, acoustic emission and time- and space-resolved reflectance spectroscopy. The techniques are correlated to understand the effect of microstructure on water and solute status, texture and optical properties and internal defects of food. In particular the consortium will consider fresh fruit, processed fruit and cereal products. The research is aimed to bring closer to the market on-line sensors for microstructure analysis and to provide tools for process design and optimization. To this end, data analysis algorithms are developed, including image processing, modelling and multivariate statistics. To reach the objectives, InsideFood joins research institutes with companies from the sensor, ICT and food sectors. 4 SMEs and 1 major food company participate in InsideFood. InsideFood is dedicated to dissemination of the project results, through a symposium, publications, IP development, a technology newsletter, a public website and a technology trade fare. The participating technology companies perform valorisation activities to implement the results in their product portfolio.

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**NBR: 226791** **ACRONYM: NAMETECH** **EC FUND: 1930800**

**DG:** RTD **Call: FP7-ENV-NMP-2008-2** **Thema:** ENV.2008.3.1.1.2.

**Title:** Development of intensified water treatment concepts by integrating nano- and membrane technologies

**Abstract:** The Nametech project harnesses benefits of nanotechnology to bring about improvements in membrane filtration for advanced water treatment. The general objective is to strengthen the European membrane market by making nanotechnology available to large scale European membrane manufacturers. A unique feature of the project is the knowledge transfer between the experienced membrane manufacturer Norit and the coating expert and new-comer to the membrane field Agfa Gevaert. The S&T focus is on the use of nano-structured materials to alter the physical and chemical properties of polymeric ultrafiltration membranes and thereby improving the filtration performance at macroscale installations. The project aims at adapting commercial nanoparticles such as TiO2 and Ag for the modification of UF membranes to reduce fouling, and thus improve its permeability (i.e. Technology Path 1). In Technology Path 2 and 3, the potential of using active nanoparticles, such as bionano-catalysts, in combination with membranes is examined to remove micropollutants such as chlorinated compounds, nitroaromatic compounds or redox active metals, thus improving the water quality. A specific novelty is the development of an integrated permeate channel concept, whereby the nanoparticles are embedded in 3D textiles, functioning as membrane support and permeate channel. The nanoparticles will be deposited on the membrane surface or embedded in the membrane (mixed matrix). The S&T challenges regarding the modification of the nanoparticles, the deposition of the nanoparticles on membrane surface as well as the production of nano-activated membranes (NAMs) will be addressed in WP 1, 2 and 3. The newly developed NAMs will

be tested at laboratory scale (WP 4) before selecting the most promising concept for testing at pilot scale (WP 5). The activities will be complemented by a toxicological study and the application of LCA to assess the environmental impacts (WP 6). The high industrial involvement puts a strong focus on the exploitation strategies and handling IPR issues (WP 7).

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**NBR: 226820** **ACRONYM: SOLAMON** **EC FUND: 1599948**

**DG:** RTD **Call: FP7-ENERGY-NMP-2008-1** **Thema:** NMP-2008-2.6-1

**Title:** Plasmons Generating Nanocomposite Materials (PGNM) for 3rd Generation Thin Film Solar Cells

**Abstract:** The objective of the SOLAMON project is to develop high potential Plasmon Generating Nanocomposite Materials (PGNM) which will pave the way to the generation III solar cells (high efficiency & low cost). The objective is an augmentation in the External Quantum Efficiency resulting in an increase of 20% in the short circuit current density of the thin film solar cells. To achieve such an ambitious goal, the project will focus on the development of fully tailored building block nanoparticles able to generate a plasmon effect for enhanced solar absorption in thin film solar cells. Such nanoparticles designed for an optimum absorption will be integrated in solar cells matrix using a recently developed room temperature deposition process. This step will result in the specific design of PGNM for solar cells using a knowledge based approach coupling modeling at both scales: nanoscopic (plasmonic structure) and macroscopic (solar cells). SOLAMON will address three different classes of solar cells: a-Si:H thin films, organics and dye sensitised. Developing the PGNM on these three classes aims at maximizing the project impact and not to compare them because scientific background acquired on these technologies could be easily transferred to other ones. As a matter of fact, a-Si:H technology targets mainly the Building Integrated PV (BIPV) market (large surfaces) whereas the two others are most suitable for the consumer good market (nomad applications). The project workprogram, the critical path and the contingencies plans are designed to maximize both social and economic impact. For this reason, the BIPV applications (i.e. a-Si:H based technology) will be firstly considered when a strategic choice occurs, keeping in mind that, even of large economic importance, the two other technologies do not have the same key BIPV environmental and social impact.

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**NBR: 227004** **ACRONYM: NEW ED** **EC FUND: 1163159**

**DG:** RTD **Call: FP7-ENV-NMP-2008-2** **Thema:** ENV.2008.3.1.1.2.

**Title:** Advanced bipolar membrane processes for remediation of highly saline waste water streams

**Abstract:** NEW ED aims at closing industrial water cycles and reducing the amount of waste water streams with highly concentrated salt loads stemming from a broad range of industrial production processes by exploiting the waste components (salts) and transforming them to valuable products. This will be achieved by developing new micro- to nano-porous bipolar membranes for bipolar electrodialysis (BPMED), a new membrane module concept and by integrating this new technology into relevant production processes. The bipolar membrane process produces acids and bases from their corresponding salts by dissociating water at the interface within the bipolar membranes. However, BPMED so far has been applied only in niche markets due to limitations of the current state of membrane and process development. Major drawbacks of the classic BPMED process are low product purity, limited current density and formation of metal hydroxides at or in the bipolar membrane. The objective of this project is to overcome these limitations by developing a new bipolar membrane and membrane module with active, i.e. convective instead of diffusive water transport to the transition layer of the bipolar membranes, where water dissociation takes place. The key feature of the innovative new bipolar membranes is a nano- to micro-porous and at the same time ion conducting intermediate transition layer, through which water is convectively transported from the side into the transition layer. The porous transition layer may have either the character of a cation or an anion exchanger. Several promising intermediate layer materials together with different monopolar ion-exchange layers will be tested and characterized. Membrane manufacturing and new module concepts will be investigated to exploit the full potential of the new bipolar membrane technique. Integration of the developed membranes and modules into relevant production processes is an essential part of the project.

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**NBR: 227012** **ACRONYM: SPIRIT** **EC FUND: 6990864**

**DG:** RTD **Call: FP7-INFRASTRUCTURES-2008-1** **Thema:** INFRA-2008-1.1.1

**Title:** Support of Public and Industrial Research using Ion Beam Technology

**Abstract:** SPIRIT is an Integrating Activities project integrating 7 leading ion beam facilities and 4 research providers from 7 Member States and 1 Associated State. The 7 partners providing TransNational Access supply ions in an energy range from ~10 keV to 100 MeV for modification and analysis of solid surfaces, interfaces, thin films and nanostructured systems. The techniques cover materials, biomedical and environmental research and technology, and are complementary to the existing synchrotron and neutron radiation networks. The partners have highly complementary equipment and areas of specialization. SPIRIT will increase User access and the quality of research by sharing best practice, balancing supply and demand, harmonizing procedures and extending the

services into new emerging fields and to new users especially from the NMS and industry. An independent International User Selection Panel will examine proposals under a common SPIRIT procedure. Networking activities include the development of common standards for quality assessment; training and consultancy for User researchers and foresight studies. Joint Research Activities will promote emerging fields such as targeted single ion implantation for irradiation of living cells; ion-beam based analysis with ultrahigh depth resolution; ion-based 3-D tomography, and chemical and molecular imaging. Joint efforts are necessary to improve the systems for detection of ion-induced secondary radiation and to develop means to reduce sample deterioration by the analyzing ion beam. Finally, a unified software package for ion-beam based analysis shall be developed and made available to the community. The management structure of SPIRIT will consist of a Management Board, 3 Activity Boards (Networking, Transnational Access and Joint Research) and a Project Steering Team. A European Users Panel will provide input on user needs, evaluate service improvements against the benchmark level and assess new capabilities resulting from the JRA.

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**NBR: 227017** **ACRONYM: CLEAN WATER** **EC FUND: 1705224**

**DG:** RTD **Call: FP7-ENV-NMP-2008-2** **Thema:** ENV.2008.3.1.1.2.

**Title:** Water Detoxification Using Innovative vi-Nanocatalysts

**Abstract:** The concept of the project is based on the development of innovative nanostructured UV-Visible photocatalysts for water treatment and detoxification by using doped TiO2 nanomaterials with visible light response. The project aims at an efficient and viable water detoxification technology exploiting solar energy and recent advances in nano-engineered titania photocatalysts and nanofiltration membranes for the destruction of extremely hazardous compounds in water. To this aim, the UV-vis responding titania nanostructured photocatalysts will be stabilized on nanotubular membranes of controlled pore size and retention efficiency as well as on carbon nanotubes exploiting their high surface area and unique electron transport properties to achieve photocatalytically active nanofiltration membranes. This will be the crucial component for the fabrication of innovative continuous flow photocatalytic-disinfection-membrane reactors for the implementation of a sustainable and cost effective water treatment technology based on nanoengineered materials. Comparative evaluation of the UV-visible and solar light efficiency of the modified titania photocatalysts for water detoxification will be performed on specific target pollutants focused mainly on cyanobacterial toxin MC-LR and endocrine disrupting compounds (EDC) in water supplies as well as classical water pollutants such us phenols, pesticides and azo-dyes. Particular efforts will be devoted on the analysis and quantification of degradation products. The final goal is the scale up of the photocatalytic reactor technology and its application in lakes, tanks and continuous flow systems for public water distribution.

**NBR: 227057** **ACRONYM: INNOVASOL** **EC FUND: 2899510**

**DG:** RTD **Call: FP7-ENERGY-NMP-2008-1** **Thema:** ENERGY.2008.10.1.2

**Title:** Innovative Materials for Future Generation Excitonic Solar Cells

**Abstract:** INNOVASOL aims to develop radically new nanostructured materials for photovoltaic (PV) excitonic solar cells (XSCs) really competitive with traditional energy sources. The main objective is to leapfrog current limitations of third-generation PV devices through a drastic improvement of the materials used for assembling XSCs. The first step is the substitution of the liquid electrolytes, currently used in dye-sensitised solar cells, with solid-state hole conductors. In parallel, semiconductor quantum dots (QDs) with tuned band gap, designed to enhance the photon capture efficiency, will replace the organic dyes as light absorbers. A striking improvement is expected from multi exciton generation (MEG) effects, overcoming the Shockley-Queisser efficiency limit of 31% for the PV conversion. In a second step, highly innovative QDs will be designed and synthesized: the QDs will be covered by self-assembled monolayers of amphiphilic dye molecules, mimicking the photosynthetic antenna system. The dye molecules will act as molecular relays (MRs), which connect the QDs to the transparent conductive oxide (TCO). Novel TCO architectures will be developed for efficient interface energy transfer and electron diffusion. Six academic institutions guarantee an interdisciplinary research, based on top level theoretical and experimental approaches. The high degree of knowledge of solid-state physics and chemistry, nanoscience and nanotechnology of the researchers assures that the new concepts and the objectives proposed will be successfully developed/pursued. Fiat research center and Solaronix, a SME leader in the XSCs production, will provide proof-of-concept prototypes to validate the innovative materials developed by the academic partners. Materials and technological solutions of INNOVASOL are original and will pave the way for future generation XSCs alternative to devices so far developed both inside and outside Europe.

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**NBR: 227078** **ACRONYM: PROSUITE** **EC FUND: 4782196**

**DG:** RTD **Call: FP7-ENV-2008-1** **Thema:** ENV.2008.3.3.2.1.

**Title:** Development and application of standardized methodology for the PROspective SUstaInability assessment of TEchnologies

**Abstract:** The main goal of PROSUITE is to develop a framework methodology, operational methods and tools for the sustainability assessment of current and future technologies over their life cycle, applicable to different stages of maturity. The project will apply the

methodology for four technology cases with close consultation of the stakeholders involved, which includes cases from biorefineries, nanotechnology, information technologies, and carbon storage and sequestration. PROSUITE will show (i) how to combine technology forecasting methods with life cycle approaches, and (ii) how to develop and possibly combine the economic, environmental and social sustainability dimensions in a standardized, comprehensive, and broadly accepted way. PROSUITE will create a solid research basis for technology characterization, including the identification of decisive technology features, basic engineering modules for estimations of material flows and energy use, and learning curves. For the economic assessment, methods for the assessment for economic and sectoral impacts of novel technologies will be developed and combined with background data for scenario-based life-cycle inventory modelling. For the environmental assessment, state-of-the-art environment indicators will be proposed together with targeted method development for the assessment of geographically explicit land and water use impacts, metal toxicity and outdoor nanoparticle exposure. For the social assessment, a set of quantitative and qualitative social indicators will be selected via participatory approaches, setting the standard for future assessments. The use of various multicriteria assessment methods will be explored to aggregate across indicators. The methods developed will be part of a decision support system, which will be output as open source modular software.

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**NBR: 227135** **ACRONYM: CARBONANOBRIDGE** **EC FUND: 2500000**

**DG:** ERCEA **Call: ERC-2008-AdG** **Thema:** ERC-AG-PE5

**Title:** Neuron Networking with Nano Bridges via the Synthesis and Integration of Functionalized Carbon Nanotubes

**Abstract:** We propose the development of novel nanodevices, such as nanoscale bridges and nanovectors, based on functionalized carbon nanotubes (CNT) for manipulating neurons and neuronal network activity in vitro. The main aim is to put forward innovative solutions that have the potential to circumvent the problems currently faced by spinal cord lesions or by neurodegenerative diseases. The unifying theme is to use recent advances in chemistry and nanotechnology to gain insight into the functioning of hybrid neuronal/CNT networks, relevant for the development of novel implantable devices to control neuronal signaling and improve synapse formation in a controlled fashion. The proposal s core strategy is to exploit the expertise of the PI in the chemical control of CNT properties to develop devices reaching various degrees of functional integration with the physiological electrical activity of cells and their networks, and to understand how such global dynamics are orchestrated when integrated by different substrates. An unconventional strategy will be represented by the electrical characterization of micro and nano patterned substrates by AFM and conductive tip AFM, both before and after neurons have grown on the substrates. We will also use the capability of AFM to identify critical positions in the neuronal network, while delivering time-dependent chemical

stimulations. We will apply nanotechnology to contemporary neuroscience in the perspective of novel neuro-implantable devices and drug nanovectors, engineered to treat neurological and neurodegenerative lesions. The scientific strategy at the core of the proposal is the convergence between nanotechnology, chemistry and neurobiology. Such convergence, beyond helping understand the functioning and malfunctioning of the brain, can stimulate further research in this area and may ultimately lead to a new generation of nanomedicine applications in neurology and to new opportunities for the health care industry.

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**NBR: 227177** **ACRONYM: SMALLINONE** **EC FUND: 1825000**

**DG:** RTD **Call: FP7-ENERGY-NMP-2008-1** **Thema:** ENERGY.2008.10.1.2

**Title:** Smart Membrane for hydrogen energy conversion: All fuel cell functionalities in One Material

**Abstract:** A breakthrough of Proton Exchange Membrane Fuel Cells (PEMFC) requires a radical performances improvement of the key fuel cell material components (catalysts and protonic membrane) as well as highly innovative solutions to overcome the membrane assembly and integration limitations. Actual PEM fuel cells presents Membrane Electrode Assembly (MEA) architecture corresponding to a proton conductive membrane hot pressed between two catalytic electrodes. However, the MEA performance is limited by the interface effect between catalytic layer and membrane. To overcome this problem, the SMAllInOne project introduces a “SMart All in One” membrane concept. In this approach, a catalytic network is directly implanted in the thin film protonic membrane. This novel composite material is particularly well adapted for fuel cell technologies as there is no boundary between the membrane and the electrodes. Moreover, several functionalities will be added to this material in order to confer it smart properties such as water and crossover management, tailored porosity and 3D conformability. The scientific and technological objectives of the project are: • To synthesize bifunctional polymerizable and volatile precursors (alkenyl & sulfonyl) to prevent the destruction of the acidic functions during the thin film membrane realization • To create a network of percolated platinum nano-particles inside both faces of the membrane to ensure simultaneously a good catalytic efficiency and electronic conductivity • To enhance electronic conductivity by a tailored doping of material with gold particles by the surface • To study and propose a water and crossover management solution by adding functional hydrophilic particles to keep the membrane wet and Pt particles to getter hydrogen linkage • To avoid the fuel depletion by controlling the porosity using a porogen approach The consortium consists of 7 partners from 5 European countries including 2 SMEs.

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**NBR: 227179** **ACRONYM: NANOPEC** **EC FUND: 2699909**

**DG:** RTD **Call: FP7-ENERGY-NMP-2008-1** **Thema:** ENERGY.2008.10.1.2

**Title:** Nanostructured Photoelectrodes for Energy Conversion

**Abstract:** To address the challenges of photon capture and energy conversion, we will investigate solar-driven hydrogen production via photoelectrochemical water splitting. Although the concept is extremely attractive as a method of sustainable fuel production, no single material with acceptable performance, stability, and cost has been found, despite decades of investigation. To address this significant challenge, we will use new concepts and methods, afforded by nanotechnology, to design innovative composite nanostructures in which each component performs specialized functions. These novel nanocomposites will decrease the number of criteria that any single component must meet, thus overcoming the basic materials limitations that have hindered development. Computational studies will be used to assist in the selection of optimal material pairings and a wealth of advanced analytical techniques will be employed to improve the understanding of structure-composition-property relationships. As a final objective, we will use NanoPEC's innovations to develop a 1 square-centimeter test device that converts solar energy to hydrogen energy with a sustained 10% efficiency and a maximum performance decay of 10% over the first 5,000 hours of operation and a 100 square-centimeter test device with a sustained 7% efficiency and similar stability, representing a performance standard that goes well beyond the state-of-the-art. NanoPEC's innovative research will redefine the field of photoelectrochemistry and place Europe at the forefront of nanoscience and nanotechnology research by contributing to leadership in this strategically important area.

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**NBR: 227192** **ACRONYM: SOLHYDROMICS** **EC FUND: 2779679**

**DG:** RTD **Call: FP7-ENERGY-2008-FET** **Thema:** ENERGY.2008.10.1.1

**Title:** Nanodesigned electrochemical converter of solar energy into hydrogen hosting natural enzymes or their mimics

**Abstract:** Leaves can split water into oxygen and hydrogen at ambient conditions exploiting sun light. Prof. James Barber, one of the key players of SOLHYDROMICS, was the recipient of the international Italgas Prize in 2005 for his studies on Photosystem II (PSII), the enzyme that governs this process. In photosynthesis, H2 is used to reduce CO2 and give rise to the various organic compounds needed by the organisms or even oily compounds which can be used as fuels. However, a specific enzyme, hydrogenase, may lead to non-negligible H2 formation even within natural systems under given operating conditions. Building on this knowledge, and on the convergence of the work of the physics,

materials scientists, biochemists and biologists involved in the project, an artificial device will be developed to convert sun energy into H2 with 10% efficiency by water splitting at ambient temperature, including: -) an electrode exposed to sunlight carrying PSII or a PSII-like chemical mimic deposited upon a suitable electrode -) a membrane enabling transport of both electrons and protons via e.g. carbon nanotubes or TiO2 connecting the two electrodes and ion-exchange resins like e.g. Nafion, respectively -) a cathode carrying the hydrogenase enzyme or an artificial hydrogenase catalyst in order to recombine protons and electrons into pure molecular hydrogen at the opposite side of the membrane The project involves a strong and partnership hosting highly ranked scientists (from the Imperial College London, the Politecnico di Torino and the GKSS research centre on polymers in Geesthacht) who have a significant past cooperation record and four high-tech SMEs (Solaronix, Biodiversity, Nanocyl and Hysytech) to cover with expertise and no overlappings the key tasks of enzyme purification and enzyme mimics development, enzyme stabilisation on the electrodes, membrane development, design and manufacturing of the SOLHYDROMICS proof-of-concept prototype, market and technology implementation studies

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**NBR: 227243** **ACRONYM: NANOBE** **EC FUND: 2995082**

**DG:** RTD **Call: FP7-KBBE-2008-2B** **Thema:** KBBE-2008-3-2-03

**Title:** Nano- and microtechnology -based analytical devices for online measurements of bioprocesses

**Abstract:** There is a growing need for effective monitoring of the micro-organisms and bioprocesses used in the sustainable production of fuels, chemicals and pharmaceuticals. The NANOBE -consortium will develop a compact, flexible analysis tool for reaction monitoring applications in the industrial biotechnology industry. The result of the NANOBE –project will be an integrated measurement platform for real-time monitoring of industrial bioprocesses. This versatile platform will enable simultaneous analysis of dozens of analytes, including individual cells, product profiles and intracellular biomarkers. The platform will be composed of multiple 'lab-on-chip ' modules. Together, these modules will measure a broad range of analyte types, including small molecules, proteins, enzymes, metabolites, specific mRNAs and entire cells. The measurement platform will be a significant improvement in terms of automation, analysis time, identification and sensitivity. The analysis platform will permit real-time feedback control of large-scale production processes, screening of production organisms and optimisation of reaction conditions. The tool will improve process productivity, product quality and accelerate development of production organisms for applications in industrial biotechnology. The platform is designed to be flexible so that it can be applied either as a multiplex platform system to monitoring multiple analytes, or as individual device components for analysis of specific compounds. The versatile measurement tool will require only a change in method (e.g. a

change of reagents or analysis conditions) to enable the measurement of a new analyte. The NANOBE consortium combines world-class expertise in microfluidics, nano- and microfabrication techniques, photonics, electronics, sensor technologies, and biotechnology. The platform will exploit the scaling laws associated with microfluidic devices to reduce analysis time and sample volume.

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**NBR: 227407** **ACRONYM: THERMONANO** **EC FUND: 2638387**

**DG:** RTD **Call: FP7-ENERGY-2008-1** **Thema:** ENERGY.2008.8.1.1

**Title:** LOW-TEMPERATURE HEAT EXCHANGERS BASED ON THERMALLY-CONDUCTING POLYMER NANOCOMPOSITES

**Abstract:** Low temperature heat recovery is often limiting the energy efficiency of industrial processes. Low temperature differences imply large exchange surfaces which are unfeasible from the economic (expensive metal are needed to withstand the presence of condensates) and technical (too large volumes for the specific application contexts) viewpoints. The present project aims at developing nanofilled-polymer-based heat exchangers enabling: i) effective heat conductivity due to the percolation network of carbon or metal fillers; ii) cost reduction compared to metal materials (stainless steel, Cu-alloys,…); iii) design flexibility for an intensive volume exploitation; iv) superior corrosion resistance; v) promotion of the highly effective drop condensation with hydrophobic polymers. Three main application areas are devised: 1. Intercoolers increasing the efficiency of large diesel engines, where heat conductive plastics can provide a cheaper alternative to Cu-alloys when seawater is used as the cooling media (e.g. large naval engines or power plants close to sea side). 2. Heat recovery systems from combustion flue gases acting below 300°C, where commercial metal-based systems loose cost-effectiveness. 3. Application in the chemical and process industries where harsh chemicals or corrosive environments have to be faced. The project is divided into three main work lines: i) development of compounds in which a range of polymers (nylon, PET,…) and fillers (carbon fibres, carbon nanotubes, metal coated nanoparticles, …) will be considered; ii) tailoring of plastic forming techniques (injection moulding, pressing, extrusion); iii) manufacturing & testing of up to two proof-of-concept heat exchangers. The partnership includes two Universities (POLITO-I, TUBAF-D), two research centres (CEA-F, PISAS-SK), three SMEs (Astrarefrigeranti-I, Nanocyl-B, Starom-RO) and two large companies (Simona-D, SGL Carbon-D) selected for their specific expertise to undertake the above challenges.

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**NBR: 227428** **ACRONYM: SIMOSOMA** **EC FUND: 1836000**

**DG:** ERCEA **Call: ERC-2008-AdG** **Thema:** ERC-AG-PE4

**Title:** Single molecules in soft matter: dynamical heterogeneity in supercooled liquids and glasses

**Abstract:** Single-molecule optical microscopy provides average-free, dynamical and structural information about condensed matter at molecular scales. Single fluorescent molecules can now be located and tracked with a spatial resolution as high as a few tens of nanometers, even at depths as large as several microns. These capabilities are ideal to link the macroscopic physical properties of soft condensed matter with the structure, organization and dynamics of the constituent molecules. Perhaps the most surprising conclusion drawn from single-molecule observations is the unsuspected heterogeneity of molecular assemblies, both in time and space, which had remained largely hidden in conventional ensemble experiments. The structural glass transition is said to be one of the hardest open problems in condensed matter science. Although most agree on the crucial part played by heterogeneity in this process, the guesses vary wildly as to the scale and relaxation times of the inhomogeneities. Our recent discovery of glassy rheology in supercooled glass formers, following earlier observations of heterogeneity, has been received with much interest in the complex liquids community. I am convinced that single-molecule studies have the potential to radically change our view of supercooled liquids and glasses. In a broader sense, molecular insight from chemical physics complements the general ideas developed by statistical physicists. I believe it is the missing link toward a molecular control of the physical properties of soft materials. I propose to perform a broad range of novel single-molecule experiments using a micro-rheological cell to apply mechanical stress, strains and/or temperature jumps. In particular, we will perform mechanical studies of solid-solid friction, and temperature-jump studies of single proteins and single protein complexes.

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**NBR: 227430** **ACRONYM: VIN** **EC FUND: 1324983**

**DG:** ERCEA **Call: ERC-2008-AdG** **Thema:** ERC-AG-PE4

**Title:** Video-rate Scanning Probe Microscopy Imaging of Nanostructures on Surfaces

**Abstract:** The goal of this ERC proposal VIN is to develop the next generation of scanning probe microscopes (SPMs) The microscopes will set new standards in the field through their ability to acquire images at video-rate frequency, while retaining high (atomic) resolution capability. This new instrumental platform will be implemented both under ultra-high vacuum conditions, in a high-pressure gas cell, and under liquid-phase conditions. It will be utilized to create and explore novel research avenues for the study of physical, chemical, and biological surface processes at the single-atom/molecule level with the highest possible spatial and temporal resolution. In particular I will study dynamic phenomena in surface nanostructures, focusing on three mutually synergetic

and interdisciplinary priority areas: i) Catalytic reactivity of nanostructures, ii) Self-organisation of organic molecules at surfaces, iii) Biomolecular structures, processes and interactions under physiological conditions. The adsorption, diffusion and interaction of molecules are the basic steps involved in reactions at surfaces. All of them are dynamic processes, where high temporal resolution can provide new groundbreaking insight into e.g. the mechanisms underlying catalysis. Video-rate SPMs will also facilitate investigations of the kinetic aspects of molecular self- organisation at surfaces such as diffusion, intra-molecular conformational dynamics, nucleation and growth of structures. The effort will build upon the world-leading expertise in design, construction and use of SPMs in my research group at the Interdisciplinary Nanoscience Center (iNANO) and the Department of Physics and Astronomy, University of Aarhus, Denmark. To achieve the ambitious research goals, I will bring together an interdisciplinary team of highly talented younger scientists.

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**NBR: 227457** **ACRONYM: SEPON** **EC FUND: 2026800**

**DG:** ERCEA **Call: ERC-2008-AdG** **Thema:** ERC-AG-PE4

**Title:** Search for emergent phenomena in oxide nanostructures

**Abstract:** Oxide nanostructures in low dimensions on well-defined metal surfaces form novel hybrid systems with tremendous potential and impact in fundamental research and for the emerging nanotechnologies. The focus of the project is on the fabrication of two-, quasi-one-, and quasi-zero-dimensional oxide nanostructure model systems suitable for elucidation of their emergent properties in terms of structure, electronics, magnetism, and catalytic chemistry. This will be achieved by controlled self-assembly in ultrahigh vacuum, with atomic-scale precision, and in-situ characterisation employing the full palette of modern surface science methodology. Established kinetic preparation routes as well as a new approach to steer the self-assembly via external fields will be applied to the growth of a variety of transition metal oxides on suitable substrate surface templates. The stabilisation mechanism of polar oxide surfaces in nanoscale oxide objects, the catalytic chemistry of a nanoscale inverse model catalyst consisting of oxide nanowires coupled to an array of one-dimensional metal step atoms, and the magnetic properties of a surface-supported oxide quantum dot superlattice will be among the emergent phenomena to be probed in this project. Such fundamental questions will be addressed in a close collaboration between state-of-the-art experimental and theoretical techniques. The possibility to separate dimensionality from nanoscale effects made possible by the model systems created here will add an extra dimension in the understanding of oxide nanophase systems.

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**NBR: 227463** **ACRONYM: ATMNUCLE** **EC FUND: 2000000**

**DG:** ERCEA **Call: ERC-2008-AdG** **Thema:** ERC-AG-PE10

**Title:** Atmospheric nucleation: from molecular to global scale

**Abstract:** Atmospheric aerosol particles and trace gases affect the quality of our life in many ways (e.g. health effects, changes in climate and hydrological cycle). Trace gases and atmospheric aerosols are tightly connected via physical, chemical, meteorological and biological processes occurring in the atmosphere and at the atmosphere-biosphere interface. One important phenomenon is atmospheric aerosol formation, which involves the production of nanometer-size particles by nucleation and their growth to detectable sizes. The main scientific objectives of this project are 1) to quantify the mechanisms responsible for atmospheric new particle formation and 2) to find out how important this process is for the behaviour of the global aerosol system and, ultimately, for the whole climate system. Our scientific plan is designed as a research chain that aims to advance our understanding of climate and air quality through a series of connected activities. We start from molecular simulations and laboratory measurements to understand nucleation and aerosol thermodynamic processes. We measure nanoparticles and atmospheric clusters at 15-20 sites all around the world using state of the art instrumentation and study feedbacks and interactions between climate and biosphere. With these atmospheric boundary layer studies we form a link to regional-scale processes and further to global-scale phenomena. In order to be able to simulate global climate and air quality, the most recent progress on this chain of processes must be compiled, integrated and implemented in Climate Change and Air Quality numerical models via novel parameterizations.

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**NBR: 227497** **ACRONYM: ROD-SOL** **EC FUND: 2699842**

**DG:** RTD **Call: FP7-ENERGY-NMP-2008-1** **Thema:** NMP-2008-2.6-1

**Title:** All-inorganic nano-rod based thin-film solarcells on glass

**Abstract:** Thin film solar cells, based on non-toxic, abundant and air-stable silicon (Si) will probably, based on forecasts, dominate the photovoltaic market in the future and thus replace bulk Si from its leading position. This prognosis is fostered by the strong cost reduction potential due to highly effective materials utilization at low energy consumption. However, thin film Si suffers from inherently small grains, which limits efficiencies to ~10% due to carrier recombination at grain boundaries. A radical innovation of the Si thin film materials synthesis route is needed to circumvent this problem. ROD_SOL aims at the synthesis of Si nano-rods, densely packed at sufficiently large diameters (few 100 nm's) and lengths (>1µm for sufficient carrier absorption in indirect semiconductors) directly on cheap substrates like glass or flexible metal foils. The idea is to grow Si nano-rods from the gas phase that are inherently defect free, with

a wrapped around pn-junction that bares the potential to decouple absorption of light from charge transport by allowing lateral diffusion of minority carriers to the pn-junction, which is at most a few hundred nm away, rather than a few µm as in conventional thin film solar cells. That way, efficiencies as in bulk Si are expectable, however, with the advantage that the 'nano-rod carpet' layer, is at most a few µm thick. A 'nano-rod carpet' that thin shows a strongly increased optical absorption. Thus, the 'nano-rod carpet' is not only the active solar cell element but at the same time its own light trapping structure. For synthesis of the nano-rods, development of suitable contact materials and characterization of physical and structural properties four experienced research institutes have joined forces. Despite the fundamental materials research to be in focus, three companies joined the consortium to directly test and implement the novel materials and processes in a well proven, industrially viable thin film solar cell concept.

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**NBR: 227541** **ACRONYM: MAHEATT** **EC FUND: 2545732**

**DG:** RTD **Call: FP7-ENERGY-NMP-2008-1** **Thema:** NMP-2008-2.6-1

**Title:** Materials for high energy accumulators in traction and tools

**Abstract:** A.1.2. Project summary The overall objective of the MAHEATT project is to develop a prototype cost-effective lithium-ion high energy battery technology with electrode performances well beyond the current state-of-the-art, with automotive applications (hybrid vehicles and electric traction) and hand held tools as application target areas. This will be achieved by innovative synthesis and design of radically improved cathode materials and by optimizing kinetics and stability through nanostructuring of all electroactive materials (EAMs) and components. Main objectives are: • To design synthesis routes and novel electroactive materials for the cathode and for the anode with a much higher specific capacity compared to present EAMs; • To design the EAMs in nanoscopic form to provide a faster kinetics; • To coat the EAMs by a porous conductive layer to suppress undesired (electro-)catalysis and to enhance electronic conductivity; • To optimize binding and assembly of the EAMs into a nanoporous network forming an excellent percolation system for Li-ions and for the electrolyte. The approach is highly cross-disciplinary, with partnership of leading research institutions and leading European industry. The solution to the materials challenges will benefit from integrated feedback between advanced characterization, theory, modelling, synthesis and up-scaling. The key objective for our target materials and systems in relation to electric traction in the automotive sector is a battery that utilizes at least 1.5 times (i.e. 240 mAh/g) larger charge density than current state-of-the art cathode materials.

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**NBR: 227560** **ACRONYM: EFFIPRO** **EC FUND: 2540258**

**DG:** RTD **Call: FP7-ENERGY-NMP-2008-1** **Thema:** ENERGY.2008.10.1.2

**Title:** Efficient and robust fuel cell with novel ceramic proton conducting electrolyte

**Abstract:** EFFIPRO will develop electrolytes and electrodes for proton conducting fuel cells (PCFCs) based on novel LaNbO4-type and similar proton conducting oxides that, unlike earlier candidates, are chemically stable and mechanically robust. The transport of H+ makes water form on the cathode side, avoiding fuel dilution and recycling and reducing risk of destructive anode oxidation, even at peak power. Moreover, the high operating temperature (e.g. 600 °C) alleviates recycling of liquid water and coolants, and provides efficient heat exchange with heat grids or fossil fuel reformers. All these give PCFCs major benefits in fuel utilisation, overall efficiency, and system simplicity with reformed fossil fuels as well as hydrogen from renewables. However, the proton conductivities of candidate materials are insufficient, and the project aims to improve proton conductivity through doping strategies and interface engineering, investigating new classes of stable proton conducting oxides, and developing technologies for thin film electrolytes on suitable substrates. Novel cathodes will be devised, all to bring area-specific electrolyte and interface resistances down to 0.2 Ωcm2 each within this first project. New production routes of precursors and materials are included, as well as surface kinetics research and cost reduction by mischmetal strategies. The project is accompanied by complementary national initiatives and projects e.g. on fundamental characterisation and interconnects. Novel PCFC technology involves high risk and long term research that needs concerted action from many actors including the emerging nano-ionics field. It is the aim that PCFCs by 2020 will be available, accelerate the use of fuel cells, reduce CO2 emissions, and increase efficiency by 10 % where applied, promote the hydrogen society, and be a dominating fuel cell technology. The project counts 7 partners in 5 countries, with leadership and PCFC dedication. It lasts 3 years and educates/trains 5 PhD/post-docs.

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**NBR: 227577** **ACRONYM: PLASMONICS** **EC FUND: 2200000**

**DG:** ERCEA **Call: ERC-2008-AdG** **Thema:** ERC-AG-PE2

**Title:** Frontiers in Surface Plasmon Photonics - Fundamentals and Applications

**Abstract:** Surface plasmons have generated considerable renewed interest through a combination of scientific and technological advances. In particular with the progress nanofabrication techniques, the properties of surface plasmons (SP) can now be controlled by structuring metals at the nanometer scale. The overall objective of this proposal is to manipulate and control the properties of the SPs to analyze fundamental phenomena through which new capacities can emerge. The project is divided in four parts with strong overlap: 1) SP enhanced devices: We plan to use the benefits provided by SPs to

enhance devices or create new device architectures. Textured metal surfaces, and the associated SP modes, can be used as antennas to extract, capture and control light in a variety of applications that include imaging and polarization sensing, nano-optical elements and detectors. 2) SP circuitry: To achieve complete miniature SP photonic circuits, a number of components to launch SP, control their propagation and finally decouple SP back to light are necessary. Much progress has been made in this direction but many challenges remain at the level of individual components and complete circuits that will be explored. 3) Molecule SP interactions: Molecule - SP strongly coupled interactions are expected to modify extensively photophysical and photochemical processes that will be studied by time resolved techniques. This issue also has implications for generating all optical control needed in SP circuitry. 4) Casimir effect and SPs: The tailoring of the Casimir force by enhancing the contribution of SP modes has been proposed by theoretical studies. Experiments will be undertaken to test the relationship between Casimir physics and plasmonics using nanostructured metal surfaces which could have significant consequences for nano-electro-mechanical systems. For each of these subjects, the objectives are at the cutting edge of the surface plasmon science and technology.

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**NBR: 227639** **ACRONYM: HYDRA-CHEM** **EC FUND: 2461600**

**DG:** ERCEA **Call: ERC-2008-AdG** **Thema:** ERC-AG-PE5

**Title:** Hydrothermal and Ionothermal Chemistry For Sustainable Materials (HYDRA-CHEM)

**Abstract:** This proposal aims to develop a novel type of chemistry by using hydrothermal or ionothermal reaction conditions to generate novel materials and polymers in a more sustainable fashion. Hydrothermal and ionothermal carbonization of sugars or crude biomass can lead directly to large scale carbon materials (and therefore to carbon-negative products and measures), and improvement by processing and hybridization with petrochemistry is expected to yield carbon structures with controlled surface chemistry and nano-morphology and therefore an extended application spectrum, useful for transfer to society. Model experiments indicate that using other simply available substances as monomers under HYDRA-conditions can result in high performance engineering plastics, ultrahigh surface materials for gas-storage, or novel fragments which are otherwise non accessible in comparable qualities under similarly sustainable conditions. That way, it is expected that HYDRA-Chem can expand synthetic chemistry in the direction of high temperatures and rather unusual solvent conditions.

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**NBR: 227669** **ACRONYM: CLEAN-ICE** **EC FUND: 1869450**

**DG:** ERCEA **Call: ERC-2008-AdG** **Thema:** ERC-AG-PE8

**Title:** Detailed chemical kinetic models for cleaner internal combustion engines

**Abstract:** The key objective of this project is to promote cleaner and more efficient combustion technologies through the development of theoretically grounded and more accurate chemical models. This is motivated by the fact that the current models which have been developed for the combustion of constituents of gasoline, kerosene, and diesel fuels do a reasonable job in predicting auto-ignition and flame propagation parameters, and the formation of the main regulated pollutants. However their success rate deteriorates sharply in the prediction of the formation of minor products (alkenes, dienes, aromatics, aldehydes) and soot nano-particles, which have a deleterious impact on both the environment and on human health. At the same time, despite an increasing emphasis in shifting from hydrocarbon fossil fuels to bio-fuels (particularly bioethanol and biodiesel), there is a great lack of chemical models for the combustion of oxygenated reactants. The main scientific focus will then be to enlarge and deepen the understanding of the reaction mechanisms and pathways associated with the combustion of an increased range of fuels (hydrocarbons and oxygenated compounds) and to elucidate the formation of a large number of hazardous minor pollutants. The core of the project is to describe at a fundamental level more accurately the reactive chemistry of minor pollutants within extensively validated detailed mechanisms for not only traditional fuels, but also innovative surrogates, describing the complex chemistry of new environmentally important bio-fuels. At the level of individual reactions rate constants, generalized rate constant classes and molecular data will be enhanced by using techniques based on quantum mechanics and on statistical mechanics. Experimental data for validation will be obtained in well defined laboratory reactors by using analytical methods of increased accuracy.

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**NBR: 227680** **ACRONYM: DARWIN** **EC FUND: 2042640**

**DG:** ERCEA **Call: ERC-2008-AdG** **Thema:** ERC-AG-PE7

**Title:** Deep mm-Wave RF-CMOS Integrated Circuits

**Abstract:** Wireless and mobile communication systems have become an important part of our daily environment. Since the introduction of the GSM-network in the early nineties, different wireless applications such as WiFi, Bluetooth, GPS, etc. have been brought into the market. This has become possible due to the high integration of integrated circuits in relatively cheap technologies. Besides the digital signal processing, those wireless applications require complex analog circuits operating at very high frequencies (RF circuits). In the early days these were implemented as discrete components or standalone ICs in expensive technologies such as GaAs, InP and SiGe. Due to the research towards nanometer CMOS technologies, and due to improved RF circuit

techniques, RF-CMOS has been introduced since the mid nineties. The intention of this research project is to take the next big leap forward in wireless applications, i.e. the exploration and research, based on the vast RF-CMOS knowledge already existing, towards the Extremely High Frequencies which is above 70 GHz up to 300GHz, with wavelengths close to 1 mm. The research project is a logical evolution of the RF-CMOS research knowledges of the team. For that the "natural evolution" acronym DARWIN (Deep mm-Wave RF CMOS Integrated Circuits (with the M of CMOS inverted (W)) is choosen. Implementing circuit techniques in standard CMOS technologies at those frequencies is again an enormous challenge and will open a lot of new opportunities and applications towards the future due to possibilities in safety monitoring, e.g. collision radar detection for automobiles at 77 GHz, the need for high data-rate telecommunication systems, with capacity of 1-10 Gbps, and imaging for medical and security systems. The goal of the proposed project is to perform the necessary fundamental basic research to be able to implement these 70-300 GHz applications in CMOS technology (45 nm and below).

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**NBR: 227690** **ACRONYM: FUNDMS** **EC FUND: 2440000**

**DG:** ERCEA **Call: ERC-2008-AdG** **Thema:** ERC-AG-PE3

**Title:** Functionalisation of Diluted Magnetic Semiconductors

**Abstract:** Low-temperature studies of transition metal doped III-V and II-VI compounds carried out over the last decade have demonstrated the unprecedented opportunity offered by these systems for exploring physical phenomena and device concepts in previously unavailable combinations of quantum structures and ferromagnetism in semiconductors. The work proposed here aims at combining and at advancing epitaxial methods, spatially-resolved nano-characterisation tools, and theoretical modelling in order to understand the intricate interplay between carrier localisation, magnetism, and magnetic ion distribution in DMS, and to develop functional DMS structures. To accomplish these goals we will take advantage of two recent breakthroughs in materials engineering. First, the attainment of high-k oxides makes now possible to generate interfacial hole densities up to 10^21 cm-3. We will exploit gated thin layers of DMS phosphides, nitrides, and oxides, in which hole delocalization and thus high temperature ferromagnetism is to be expected under gate bias. Furthermore we will systematically investigate how the Curie temperature of (Ga,Mn)As can be risen above 180 K. Second, the progress in nanoscale chemical analysis has allowed demonstrating that high temperature ferromagnetism of semiconductors results from nanoscale crystallographic or chemical phase separations into regions containing a large concentration of the magnetic constituent. We will elaborate experimentally and theoretically epitaxy and co-doping protocols for controlling the self-organised growth of magnetic nanostructures, utilizing broadly synchrotron radiation and nanoscopic characterisation tools. The established methods will allow us to obtain on demand either magnetic nano-

dots or magnetic nano-columns embedded in a semiconductor host, for which we predict, and will demonstrate, ground-breaking functionalities. We will also assess reports on the possibility of high-temperature ferromagnetism without magnetic ions.

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**NBR: 227691** **ACRONYM: QUANTUMOPTOELECTR** **EC FUND: 1800000**

**DG:** ERCEA **Call: ERC-2008-AdG** **Thema:** ERC-AG-PE3

**Title:** Quantum Opto-Electronics

**Abstract:** We propose to develop an opto-electronics interface between single-electron devices and single-photon optics. The ultimate limit in the miniaturization of electronics and photonics is at the nanometer scale. Here the signal level can be controlled at the fundamental level of a single electron for electricity and a single photon for light. These limits are actively being pursued for scientific interest with possible applications in the new area of quantum information science. Yet, these efforts occur separately in the distinct communities of solid state electronics and quantum optics. Here we propose to develop a toolbox for interfacing electronics and optics on the level of single electrons and photons. The basic building block is a nanoscale pn-junction defined in a semiconductor nanowire, which is the most versatile material system for single electron to single photon conversion. We will develop the following technology: (1) growth of complex semiconductor nanowires (2) quantum state transfer for copying the information stored in an electron quantum state onto a photon state (3) single-photon optical-chip with on-chip guiding via single plasmons and on-chip detection with a superconducting detector. Besides being fundamentally interesting by itself, this new toolbox opens a new area of experiments where qubits processed in solid state nano-devices are coupled quantum mechanically over long distances via photons as signal carriers to various kinds of other interesting quantum system (e.g. solid state quantum dots, confined nuclear spins and atomic vapours).

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**NBR: 227700** **ACRONYM: SUMO** **EC FUND: 1742145**

**DG:** ERCEA **Call: ERC-2008-AdG** **Thema:** ERC-AG-PE4

**Title:** Supramolecular Motive Power

**Abstract:** Many important biological systems have the ability of transferring mechanical energy within individual molecules across distances of 1-10 nm. The mechanisms behind such energy transfer are poorly understood. Increased knowledge about them may not only explain fundamental processes in biology, but may also enable novel approaches to energy-related problems in general and new applications in supramolecular

nanotechnology in particular. We propose to use physico-chemical methods to study how chemical, electrical and photochemical energy is converted into mechanical energy in supramolecular systems as models for the biological systems. We will concentrate on the energy conversion in proteins: ATP synthase, ion channel KvAP and Rad51, which each exemplifies a different solution to intra-molecular energy transfer. To enhance our mechanistic understanding, we will use model systems and methods that have previously been developed in the laboratory. We intend to build on our extensive expertise in spectroscopic methodology and exploit and develop further site-selected linear dichroism by molecular replacement (SSLD-MR) for studying structure and dynamics of the systems and their components. The studies here described constitute a new direction of research and a unique approach to addressing fundamental questions on energy conversion in biological systems. The results may give insights into important events in biology and new methodologies that enable us for the first time to study structural details of membrane proteins in membrane environment.

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**NBR: 227711** **ACRONYM: NANOSCULPTURE** **EC FUND: 2500000**

**DG:** ERCEA **Call: ERC-2008-AdG** **Thema:** ERC-AG-PE5

**Title:** Exploration of strains in synthetic nanocrystals

**Abstract:** I plan to grow nanometre-sized crystals in confined geometries to examine the strain distributions that result. The crystal growth will employ lithographic processing techniques, made possible by the local expertise in the central clean room facilities of the London Centre for Nanotechnology. My group is world-leading in developing a method called Coherent X-ray Diffraction (CXD). Our CXD strain images of a Pb nanocrystal were published in Nature in 2006. CXD is sensitive to strain because the X-ray diffraction pattern surrounding a Bragg peak can be decomposed into symmetric and antisymmetric parts. To a good approximation, the symmetric part can be considered to come from the real part of the electron density, while the antisymmetric part is a projection of the strain field. The phasing of the data is a critical step that uses a computer algorithm, developed by us, which acts like the lens of a 3D X-ray microscope. CXD works best for nanocrystal sizes between 40nm and 5µm, for crystals strongly attached to substrates and for isolated, fiducialised arrays of crystals that can be cross-referenced with other techniques. To create nanocrystals in this size range, we will use both a bottom-up self-assembly of materials deposited onto templated substrates, designed to introduce strain, and a top-down nanosculpture approach will use lithography techniques to create strain patterns in crystalline materials associated with shapes that are carved into them. The interpretation of the images is the main intellectual output of the project. This will be compared with finite element analysis, and the deviations interpreted as unique properties attributable to the nanoscale. All project participants will work in a design, creation, analysis, interpretation, update cycle that will reveal the new basic principles of nanocrystal structure. In the long run we will

transfer CXD technology to Europe: beamline I-13 at Diamond will be ready for CXD in 2011.

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**NBR: 227754** **ACRONYM: FUNMAT** **EC FUND: 2292000**

**DG:** ERCEA **Call: ERC-2008-AdG** **Thema:** ERC-AG-PE5

**Title:** Self-Organized Nanostructuring in Functional Thin Film Materials

**Abstract:** I aim to achieve a fundamental understanding of the atomistic kinetic pathways responsible for nanostructure formation and to explore the concept of self-organization by thermodynamic segregation in functional ceramics. Model systems are advanced ceramic thin films, which will be studied under two defining cases: 1) deposition of supersaturated solid solutions or nanocomposites by magnetron sputtering (epitaxy) and arc evaporation. 2) post-deposition annealing (ageing) of as-synthesized material. Thin film ceramics are terra incognita for compositions in the miscibility gap. The field is exciting since both surface and in-depth decomposition can take place in the alloys. The methodology is based on combined growth experiments, characterization, and ab initio calculations to identify and describe systems with a large miscibility gap. A hot topic is to elucidate the bonding nature of the cubic-SiNx interfacial phase, discovered by us in TiN/Si3N4 with impact for superhard nanocomposites. I have also pioneered studies of self-organization by spinodal decomposition in TiAlN alloy films (age hardening). Here, the details of metastable c-AlN nm domain formation are unknown and the systems HfAlN and ZrAlN are predicted to be even more promising. Other model systems are III-nitrides (band gap engineering), semiconductor/insulator oxides (interface conductivity) and carbides (tribology). The proposed research is exploratory and has the potential of explaining outstanding phenomena (Gibbs-Thomson effect, strain, and spinodal decomposition) as well as discovering new phases, for which my group has a track-record, backed-up by state-of-the-art in situ techniques. One can envision a new class of super-hard all-crystalline ceramic nanocomposites with relevance for a large number of research areas where elevated temperature is of concern, significant in impact for areas as diverse as microelectronics and cutting tools as well as mechanical and optical components.

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**NBR: 227764** **ACRONYM: PCUBE** **EC FUND: 6599997**

**DG:** RTD **Call: FP7-INFRASTRUCTURES-2008-1** **Thema:** INFRA-2008-1.1.1

**Title:** Infrastructure for Protein Production Platforms

**Abstract:** The most important prerequisite and challenge in structural biology research at the atomic level by any method is the availability of sufficiently large amounts of highly purified functional proteins due to the increasing size and complexity of target proteins or protein complexes to be analyzed. Heterologous expression in bacteria, yeast, insect, or mammalian cells combined with many attempts involving different DNA constructs that result in a large variety of protein variants is instrumental to obtain sufficiently high yields. This means high-throughput methods employing robotics and specialized infrastructure are essential to efficiently reach the state of obtaining functional protein and/or crystals for X-ray structure determination. PCUBE ('protein production platform') combines existing infrastructures and know-how of leading European laboratories in bacterial, eukaryotic expression of proteins, in high-throughput crystallization and in libraries design for the effective production and crystallization of macromolecules. The program aims at offering these various state-of-the-art platforms to research groups from EC member and associated states for the efficient production of proteins for their structural studies. Each infrastructure will offer defined procedures for applying for transnational access. Scientific selection committees will give priorities to applications by scientific criteria of excellence only. Researchers from the different sites offering infrastructure are combining efforts to improve the methods in the various areas by collaborating by joint research activities. These include the improvement of the automation for synthesising DNA constructs, for parallel expression, for improved libraries, for the efficient selection of affinity molecules from libraries to particular target proteins as well as developing new methods for crystallization at the nanoliter scale.

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**NBR: 227781** **ACRONYM: NEWMATS** **EC FUND: 2018579**

**DG:** ERCEA **Call: ERC-2008-AdG** **Thema:** ERC-AG-PE5

**Title:** New Directions in Hybrid Inorganic-Organic Framework Materials

**Abstract:** The proposed work is in the field of inorganic-organic hybrid materials, focusing mainly on dense rather than nanoporous materials. There are a huge number of opportunities in this area, especially now that is has become relatively straightforward to control the conditions under which dense, often anhydrous phases with excellent thermal stability can be synthesized. The latter have a wide range of interesting properties in terms of optics, magnetism, electronic conductivity, catalysis and so on. We shall work on such functional hybrid materials with potential applications in areas such as lighting and displays, photovoltaic cells, data storage, ferroelectrics, catalysis, and gas storage. We shall also explore some of the fundamental questions concerning hybrid frameworks: What factors control their crystalline structures? Can we reliably simulate their structures and calculate their energies? What kinds of defects can be incorporated into hybrid frameworks? How do these affect their properties? What factors influence the mechanical properties of hybrid frameworks? Can we develop a general method for

preparing nanoparticles of hybrids? The work will involve a great deal of solution-based synthesis, chemical and thermal analysis, structure determination by single crystal X-ray methods, physical property measurements (mainly optical, magnetic, electronic, and mechanical), computer simulations, and some calorimetry. Most of the facilities needed for this work are available in Cambridge, though I shall collaborate with others where appropriate (e.g. computer simulation, calorimetry).

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**NBR: 227845** **ACRONYM: MASC** **EC FUND: 2290856**

**DG:** ERCEA **Call: ERC-2008-AdG** **Thema:** ERC-AG-ID1

**Title:** MASC: Materials that Impose Architecture within Stem Cell Populations

**Abstract:** This proposal aims to harness breakthroughs in polymer science, nanotechnology and materials processing to create new classes of materials that mimic the architecture of the human body. The materials will be exploited to tackle grand challenges in stem cell science and in the development of new biomaterials that promote regeneration. The human body uses materials to impose architecture on populations of cells within developing or regenerating tissues. Architectural components of these tissues include three-dimensional spatial and temporal patterns of growth factors, spatial arrangements of multiple cell types and modulation of local elasticity. Orchestration of these architectural features is essential in the precise control of stem cell differentiation and tissue morphogenesis in vivo. This ERC Grant will create new classes of biomaterials that bridge the gap between the exquisite control of architecture in the developing human body and the crude structure imposed on cell populations in vitro during cell culture and biomaterials-assisted tissue repair. The research programme is organised into 2 major strands: TOOLS and DEMONSTRATORS. Within TOOLS, new materials and techniques will be invented that represent a step-change in our ability to impose architecture on stem cell populations in vitro. Within DEMONSTRATORS, 3 grand challenges in healthcare and stem cell science will be addressed through demonstrations that synthetic materials can be designed to match the architecture of our developing bodies. This interdisciplinary project will be undertaken by a team of interdisciplinary scientists within the Wolfson Centre for Stem Cells Tissue Engineering and Modelling (STEM). To undertake this research project help from collaborators across Europe is required. Existing and new collaborations will ensure that the most advanced materials science and stem cell biology is exploited to create world leading tools that radically change regenerative medicine.

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**NBR: 227897** **ACRONYM: MOLECULAR MOTORS** **EC FUND: 2175969**

**DG:** ERCEA **Call: ERC-2008-AdG** **Thema:** ERC-AG-PE4

**Title:** Molecular Motors - Controlling movement at the nanoscale

**Abstract:** The design of artificial molecular motors and machines is one of the major challenges in contemporary molecular sciences and bottom-up molecular nanotechnology. Whereas the protein-based molecular motors found in the living cell are amongst the most fascinating and complex structures found in nature and crucial to nearly every key biological process, the field of synthetic linear and rotary motors is still in its infancy. In a broader context moving molecular sciences from the current situation with a focus on static structures and operation under thermodynamic control to dynamic chemistries with systems under kinetic control will represent a major step beyond current frontiers of chemical sciences. Furthermore, a shift from control of structure to dynamic control of function and from molecules to molecular systems, where several components act in concert often at different hierarchical levels, makes it possible for fascinating and unique properties to be discovered. In this program the goal is to significantly push ahead the frontiers of the field of molecular motors and machines both with respect to control of translational and rotary motion, as well as the exploration of dynamic functions of molecular systems governed by molecular motors. A further extremely challenging goal is to explore synthetic systems that can undergo autonomous motion. This program builds on our recent discoveries of the first unidirectional light-driven rotary molecular motor, the chemical driven rotary motor that can complete a full rotary cycle in a repetitive manner and the first molecular defined autonomous translational motor powered by a chemical fuel. As the basic principles, rules and parameters that govern molecular motion at the nanoscale are, largely, not yet understood, the focus of this proposal is on a multidisciplinary program addressing some of the most challenging fundamental issues in this uncharted territory.

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**NBR: 227943** **ACRONYM: WALKINGMOLS** **EC FUND: 2256401**

**DG:** ERCEA **Call: ERC-2008-AdG** **Thema:** ERC-AG-PE5

**Title:** Synthetic Molecules that Walk Down Tracks: The First Small-Molecule Linear Motors

**Abstract:** The goal of this research project is to make the first synthetic small-molecule structures that can walk down tracks, mimicking the types of movement exhibited by the biological motor proteins myosin, kinesin and dynein. We propose to construct the first synthetic, mechanically processive, chemical systems from first principles; i.e. to design, synthesize, operate and characterize wholly synthetic small molecule structures that progressively advance directionally along a molecular track in response to stimuli. Different principles ( passing leg and inchworm mechanisms) for processive mechanical molecular-level motion will be developed and experimentally explored. With some designs it is envisaged that the walker units will be able to change direction or switch

between pathways as a result of external signaling or the nature of the environment and, ultimately, be able to transport a cargo from one place to another on a surface. Sequential processive movement is unprecedented for wholly synthetic molecular structures and is the key requirement for making translational/linear motors that can perform tasks (transport cargoes from place to place or progressively exert a force) at the molecular level. Its successful demonstration would be a landmark accomplishment and mark a major new direction for synthetic supramolecular chemistry and molecular nanotechnology.

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**NBR: 227950** **ACRONYM: MICROCHEMICALIMAGING** **EC FUND: 1430607**

**DG:** ERCEA **Call: ERC-2008-AdG** **Thema:** ERC-AG-PE8

**Title:** Enhancing microfabricated devices with chemical imaging for novel chemical technology

**Abstract:** The development of microchemical systems is one of the most exciting recently developed research topics with numerous potential industrial applications. One of the greatest challenges to encourage these systems to be adopted by industry is successful high level integration with sensors for understanding, optimisation and control of microsystems for various processes. The proposed research will develop such systems and their integration via linking them with chemical imaging. The benefits of chemical engineering at smaller lengthscales are manifold; the design of microchemical processes is important where, by nature, it is essential to have microdevices, e.g. in cell biology manipulation and transformations. Other processes can be designed macroscopically, but a move to microprocesses gives process advantages, such as enhanced heat and mass transfer, novel flow regimes, bringing material and process time and lengthscales into the same region to allow material property and process interactions, which would be impossible in macro-reactors. In order to achieve this, it is essential to have the capability of rapid 3D chemical imaging on a nano/microscale, as only by devising these new techniques to image microchemical systems, it will be possible to optimise them for novel engineering. The proposal is aimed at providing chemical imaging capability to miniaturised devices for the engineering of new materials and processes. It is proposed (i) to use chemical imaging and micro-deposition methods for the generation of materials with responsive gradient structures; (ii) to engineer nanostructured materials aided by high-resolution chemical imaging; (iii) to combine microfluidics with chemical imaging as a prototype of miniaturised chemical factories. The overall aim is to utilise the advantages of spectroscopic chemical imaging to develop novel miniaturised devices and materials that will serve as suitable platforms for future industrial users with wide applicability.

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**NBR: 227964** **ACRONYM: SFN** **EC FUND: 2500000**

**DG:** ERCEA **Call: ERC-2008-AdG** **Thema:** ERC-AG-ID1

**Title:** Soft Matter Nanotechnology to Create Life-Like Machines

**Abstract:** We propose several new soft-matter nanotechnology-bases where the underlying principles of operation as well as the materials used are derived or inspired by biological systems. Specifically, in one aspect we wish to develop nanoscale biomimetic components, some of them with complex capacities (such as memory functions) that can perform a task in a useful device setup and that are mainly KT-driven (thermal energy-no external power source needed). A central issue relates to remote control of nanoscale soft-matter devices using microfluidics integration. Specifically, control of reactor shape, volume, connectivity, reactant concentrations etc are proposed. In another aspect, we wish to address central questions in biochemistry, biophysics and cell biology pertaining to among other things nanotube-mediated transport in cell-and cell-hybrid networks, and reaction dynamics in geometrically fluctuating nanoenvironments.

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**NBR: 227987** **ACRONYM: RLUCIM** **EC FUND: 2291997**

**DG:** ERCEA **Call: ERC-2008-AdG** **Thema:** ERC-AG-PE5

**Title:** Resilient large unit cell inorganic materials

**Abstract:** A grand challenge in science is the controlled assembly of atoms and molecules into novel forms as the basis for new physical phenomena and next-generation technologies. This programme will focus on excellence in synthesis of advanced inorganic functional materials through the development of fundamental capabilities for control of structure and composition in crystalline materials with large unit cells that are resilient to the introduction of multiple functionality. The targeted synthesis of these materials is addressed by developing a smart intuition approach in which detailed chemical appreciation of the structure-composition-property relationships is focused by predictive computation. The task is structured as a computation and growth-led Theme 1, where nanodeposition tools and tightly controlled sub-structure selection focus the computational task, and a synthesis- and measurement lead Theme 2 where compositional and structural features controlling complex properties are identified to initially define target materials selection. Theme 1 initially addresses the assembly of modular thin film and bulk materials to permit the required methodology development. Theme 2 will identify a toolkit of chemical components by synthesis and measurement (encompassing both average and local structure and dynamics) that will then be analysed predictively by computation to identify specific compositions for synthesis. The developed capability will integrate computation as a focused tool in the synthesis of complex materials, rather than devising an approach capable of surveying all possible

compositions. It will permit the isolation of specific structures within a focused space of components, identified by structure-property-composition analysis in bulk materials (specifically those where structural frustration is imposed by competing interactions between multiple sublattices) or by selection of modules for unit cell by unit cell assembly of thin films.

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**NBR: 228023** **ACRONYM: QON** **EC FUND: 2300000**

**DG:** ERCEA **Call: ERC-2008-AdG** **Thema:** ERC-AG-PE3

**Title:** Quantum optics using nanostructures: from many-body physics to quantum information processing

**Abstract:** Spins in nanostructures have emerged as a new paradigm for studying quantum optical phenomena in the solid-state. Motivated by potential applications in quantum information processing, the research in this field has focused on isolating a single confined spin from its environment and implementing coherent manipulation. On the other hand, it has been realized that the principal decoherence mechanisms for confined spins, stemming from interactions with nuclear or electron spin reservoirs, are intimately linked to fascinating many-body condensed-matter physics. We propose to use quantum optical techniques to investigate physics of nanostructures in two opposite but equally interesting regimes, where reservoir couplings are either suppressed to facilitate coherent control or enhanced to promote many body effects. The principal focus of our investigation of many-body phenomena will be on the first observation of optical signatures of the Kondo effect arising from exchange coupling between a confined spin and an electron spin reservoir. In addition, we propose to study nonequilibrium dynamics of quantum dot nuclear spins as well as strongly correlated system of interacting polaritons in coupled nano-cavities. To minimize spin decoherence and to implement quantum control, we propose to use nano-cavity assisted optical manipulation of two-electron spin states in double quantum dots; thanks to its resilience against spin decoherence, this system should allow us to realize elementary quantum information tasks such as spin-polarization conversion and spin entanglement. In addition to indium/gallium arsenide based structures, we propose to study semiconducting carbon nanotubes where hyperfine interactions that lead to spin decoherence can be avoided. Our nanotube experiments will focus on understanding the elementary quantum optical properties, with the ultimate goal of demonstrating coherent optical spin manipulation.

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**NBR: 228029** **ACRONYM: NMNP** **EC FUND: 2100000**

**DG:** ERCEA **Call: ERC-2008-AdG** **Thema:** ERC-AG-PE2

**Title:** Nonlinear Micro- and Nano-Photonics: nonlinear optics at the micrometer scale and below

**Abstract:** We will investigate, experimentally and theoretically, the dynamics of nonlinear optical waves at mesoscopic scales, ranging from several wavelengths (~10 microns) down to the sub-wavelength regime (~0.2 microns). Our studies will cover a variety of optical settings: from various kinds of periodic systems (photonic lattices) with and without disorder, to bulk materials and nano-suspensions. Under proper conditions, light propagating nonlinearly in these systems can display complex nonlinear dynamics, giving rise to a variety of fascinating phenomena. Perhaps the most intriguing are associated with the suspensions containing dielectric nano-spheres, upon which light acts, by virtue of the gradient force, to modify the local density of spheres, thereby varying the effective refractive index. We will use light to alter the properties of the fluid (e.g., surface-tension, viscosity), which, in turn, will affect the pattern of optical wave in space and time. We will study nonlinear optics coupled directly to nonlinear fluid dynamics. Our preliminary results demonstrate optically-induced convection and optically-driven waves in the fluid. In the same system, we will explore sub-wavelength optical spatial solitons. Our preliminary experimental results clearly show very narrow solitons, narrower than imaging optics can resolve. In another effort, we will explore arrays of sub-wavelength waveguides with a sharp index contrast, and will study a variety of nonlinear phenomena unique to such structures. Other efforts include linear and nonlinear wave phenomena in photonic lattices, such as Anderson localization of lightt, the optical realization of the famous Hofstadter butterfly, waves in honeycomb lattices exhibiting unique features arising from symmetry (diabolic points, Berry phase effects, backscattering, etc.), Anderson localization in quasi-crystals and in honeycomb structures, transport of solitons in random potentials, and more.

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**NBR: 228117** **ACRONYM: SURFUND** **EC FUND: 1895152**

**DG:** ERCEA **Call: ERC-2008-AdG** **Thema:** ERC-AG-ID1

**Title:** Fundaments and Principles for Measurement and Characterization of 21st Century Science and Engineering Surfaces

**Abstract:** This proposed project explores fundaments and principles for surface measurement and characterization for ultra/nano-precision non-Euclidean geometry and deterministic surfaces, which are vital for making possible key areas of 21st century science - pure and applied, engineering and bio-engineering. The research will explore an original integrated measurement and characterization system with two major aspects: (1) Characterization: to develop radical new thinking as to what are the fundamental building blocks of a texture-characterization system and apply that thinking to non-

Euclidean and deterministic surfaces. It will explore necessary and sufficient mathematical operations and principles, surface decomposition models, distortion-free representation of texture etc. (2) Measurement: to investigate principles and enabling optical methods to on-line/in-line measurement for ultra/nano-precision non-Euclidean geometry and deterministic surfaces. The fruits of this research project will significantly facilitate surface-manufacturing control and functional performance of surfaces applied in 21st Century Science and Engineering over a wide set of sectors. Examples are surfaces used in optics and target shells in high-power laser-energy systems, optics in new earth/space-based large telescopes (e.g. the 42 m E-ELT telescope), interfaces in fluid-dynamics (energy-efficient jet engines, aircraft fuselages and wings), long-life human-joint implants, microelectronics and MEMS/NEMS devices in nanotechnology applications. The capability to perform surface quantitative measurements and characterization on the above key components does not exist today. This confronts the state-of-the-art in surface-measurement science with regard to new surface characteristics (structured or patterned surfaces), extremity of size (1 m - 2 m), ultra precision (1 in 10^9), quality, complexity of shape (non-Euclidean geometry), or combinations of these aspects.

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**NBR: 228144** **ACRONYM: INVISIBLE** **EC FUND: 2250000**

**DG:** ERCEA **Call: ERC-2008-AdG** **Thema:** ERC-AG-PE8

**Title:** Advanced Amorphous Multicomponent Oxides for Transparent Electronics

**Abstract:** Imagine having a fully transparent and flexible, foldable, low cost, displays or at the glass window of your home/office, a transparent electronic circuit, do you believe on that? Maybe you are asking me if I am writing science fiction. No I am not. In fact this is a very ambitious objective but is tangible in the framework of this project due to the already acquired experience in the development of transparent thin film transistors using novel multifunctional and multicomponent oxides that can behave as active or passive semiconductor materials. This is an interdisciplinary research project aiming to develop a new class of transparent electronic components, based on multicomponent passive and active oxide semiconductors (n and p-types), to fabricate the novel generation of full transparent electronic devices and circuits, either using rigid or flexible substrates. The emphasis will be put on developing thin film transistors (n and p-TFTs) and integrated circuits for a broad range of applications (from inverters, C-MOS like devices, ring oscillators, CCDs backplanes for active matrices, biossensor arrays for DNA/RNA/proteins detection), boosting to its maximum their electronic performances for next generation of invisible circuits. By doing so, we are contributing for generating a free real state electronics that is able to add new electronic functionalities onto surfaces, which currently are not used in this manner and that silicon cannot contribute. The multicomponent metal oxide materials to be developed will exhibit (mainly) an amorphous or a nanocomposite structure and will be processed by PVD techniques like

rf magnetron sputtering at room temperature, compatible with the use of low cost and flexible substrates (polymers, cellulose paper, among others). These will facilitate a migration away from tradition silicon like fab based batch processing to large area, roll to roll manufacturing technology which will offer significant advantages

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**NBR: 228229** **ACRONYM: OSIRIS** **EC FUND: 1999500**

**DG:** ERCEA **Call: ERC-2008-AdG** **Thema:** ERC-AG-PE7

**Title:** Open silicon based research platform for emerging devices

**Abstract:** The OSIRIS proposal will address the crucial and ultimately strategic area for the future emerging nanoelectronics, i.e. how structures and devices actually will be fabricated as physical dimensions approaches a few nanometer minimum feature size. The project title is Open silicon based research platform for emerging devices and indicates that many of the future emerging devices will be based on a silicon fabrication base platform but may not be fully based on silicon as the active semiconductor material. Over the past 10 years this research team has established a versatile fabrication technology platform in excellent condition to open up a variety of new technologies to explore nanometer minimum feature size in realizable electrical repeatable devices structures. The proposed project has five different focus areas outlined. It covers a broad range of critical research issues that can be foreseen as groundbreaking topics for the period beyond 2015. the different topics addressed are; 1) Three dimensional FET nanostructures based on SiNW and GeNW with advanced configuration. 2) New applications of SiNW with build-in strain for fast silicon-base optoelectronic devices. 3) Low frequency noise in advanced nanoelectronic structures 4) THz devices for IR-detection 5) Bio-sensor nanoelectronics for extreme bio-molecule sensitivity and real time detection of DNA. These areas are carefully chosen to assemble the right mix with predictable research success and with a few areas that can be called high gain/high risk. In particular we want to mention that focus area 2 and 4 have a great potential impact when successful but also at a certain higher risk for a more difficult implementation in future devices. There is in no cases any risk that the research will not generate high quality scientific results.

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**NBR: 228273** **ACRONYM: MEQUANO** **EC FUND: 1999843**

**DG:** ERCEA **Call: ERC-2008-AdG** **Thema:** ERC-AG-PE3

**Title:** Mesoscopic Quantum Noise: from few electron statistics to shot noise based photon detection

**Abstract:** We propose innovative approaches to electronic quantum noise going from very fundamental topics addressing the quantum statistics of few electrons transferred through conductors to direct applications with the realization of new types of versatile broadband photon detectors based on photon-assisted shot noise. We will develop electron counting tools which will not only allow to full characterization of electron statistics but also open the way to new quantum interference experiments involving few electrons or fractional charge carriers and will question our understanding of quantum statistics. Generation of few electron bunches will be obtained by the yet never done technique of short voltage pulses whose duration is limited to few action quanta, one quantum for one electron. Detection of electron bunches will be done by an unprecedented technique of cut and probe where carriers are suddenly isolated in the circuit for further sensitive charge detection. Using highly ballistic electron nanostructures such as Graphene, III-V semiconductors with light carriers, Carbone Nanotubes or simply tunnel barriers, we will bring mesoscopic quantum noise effects to higher temperature, energy and frequency range, and thus closer to applications. Inspired by late R. Landauer s saying: the noise IS the signal we will develop totally new detectors based on the universal effect of photon-assisted electron shot noise. These versatile broadband detectors will be used either for on-chip noise detection or for photon radiation detection, possibly including imaging. They will operate above liquid Helium temperature and at THz frequencies although projected operation includes room temperature and far-infrared range as no fundamental limitation is expected. The complete program, balanced between very fundamental quantum issues and applications of quantum effects, will open routes for new quantum investigations and offer to a broad community new applications of mesoscopic effects.

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**NBR: 228320** **ACRONYM: MODIFY** **EC FUND: 2863126**

**DG:** RTD **Call: FP7-NMP-2008-SMALL-2** **Thema:** NMP-2008-2.5-2

**Title:** Multi-scale modelling of interfacial phenomena in acrylic adhesives undergoing deformation

**Abstract:** In soft nanostructured materials containing polymers (such as acrylic adhesives), interfaces pose specific challenges since they are usually diffuse and can transfer stress through chain entanglements. The equilibrium structure of soft polymer interfaces is well-known, but their mechanical strength remains poorly understood. Yet many new nanostructured materials contain internal interfaces and important applications involve a contact between the soft polymer and a hard substrate. The detailed understanding and modelling of the mechanical response of these interfaces is challenging and currently prevents the use of modelling as a screening tool for new materials in important applications. We will address these problems through a specific example of application where interfaces dominate materials performance: i.e. soft nanostructured adhesives. The objectives of MODIFY is to obtain a fundamental understanding of the

complex interfacial structure-related interactions in these materials through sophisticated multi-scale modelling by addressing the following issues: (i) The mechanism(s) of stress transfer at internal interfaces between soft latex particles; this needs to be done at different scales from the molecular entanglement to the finite element level. (ii) The mechanism of stress transfer at hard/soft interfaces between the substrate and the soft adhesive. (iii) The effect of the presence of multiple internal interfaces on the macroscopic rheological properties of the material, and (iv) The respective role played by the polymer rheology and the interfaces in controlling the complex deformation field experienced by the soft adhesive during debonding. If successful, we expect that the economic impact of MODIFY will lie in the design by the industrial partners with knowledge-based methods of advanced adhesives tailored to match specific known and new substrates, and with enhanced recyclability.

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**NBR: 228439** **ACRONYM: SAFEPROTEX** **EC FUND: 3099368**

**DG:** RTD **Call: FP7-NMP-2008-SME-2** **Thema:** NMP-2008-4.0-9

**Title:** High-protective clothing for complex emergency operations

**Abstract:** The idea that constitutes the basis of the proposed project is to address the main issues that currently limit the wide acceptance of protective garments, i.e. protection against multiple hazards, extension of the life-cycle of protective garments, physiological comfort and mechanical parameters. Overall, the proposed research activities aim at addressing the complex risky conditions met in various types of emergency operations, e.g. during accidents involving the threat of chemicals, extreme weather conditions (flood, wind storms, hail etc), small scale fires, or combinations of those. The manufacture of three prototypes is provisioned. In order to achieve these objectives, progress beyond the state of the art is required in a variety of fields. In fact, the project is highly multidisciplinary and requires developments in diverse areas such as polymers science and technology, polymers processing, new additive masterbatches development and fiber spinning, nanotechnology, plasma technology, sol-gel technology, smart thermoregulating materials, microencapsulation, ergonomic garment design, etc. The major innovations regard, but are not limited to, the development and application of specific functionalizing materials, capable of providing multiple protective functions. More specifically, the main materials to be examined include layered silicates, carbon nanotubes, alkoxysilane primers, chromic materials, antimicrobial microspheres, etc.

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**NBR: 228455** **ACRONYM: NANOGOLD** **EC FUND: 3519235**

**DG:** RTD **Call: FP7-NMP-2008-SMALL-2** **Thema:** NMP-2008-2.2-2

**Title:** SELF-ORGANIZED NANOMATERIALS FOR TAILORED OPTICAL AND ELECTRICAL PROPERTIES

**Abstract:** The NANOGOLD project aims at the fabrication and application of bulk electro-magnetic metamaterials. A promising new concept for the exploration of metamaterials is the use of periodic structures with periods considerably shorter than the wavelength of the operating electromagnetic radiation This concept allows to control the refractive properties. Making use of a bottom up approach in materials design, we will apply self-organization of organic-inorganic composite materials containing resonant entities. To tune electromagnetic properties, resonance and interference at different length scales will be implemented. In such a way we will obtain bulk optical metamaterials operating in spectral domains appropriate for photonics that can be used in applications. Our groundbreaking solution to form such artificial matter is interdisciplinary and combines inorganic chemistry, organic macromolecular synthesis, physics of electromagnetic resonances and liquid crystal technology. We start with resonant entities (metallic nanoparticles) and organize them via self-organization on the molecular scale. Systematic modular variation of the chemical entities gives access to libraries of materials which will be used to arrive at systems with desired properties. Simulation of optical properties and molecular ordering will guide the design of compounds and materials. Organization at molecular level leads to homogenous materials with optical, electronic or magnetic properties at elevated frequencies, in the visible and near infrared spectral range. The controlled utilization of the polymer physics of micro-segration, will allow for additional structuration at the nano-scale giving design freedoms to tune material properties optimally. NANOGOLD furthermore will make use of innovative fabrication techniques and processing known from liquid crystal displays by exploring new physical effects, which will result in novel devices.

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**NBR: 228464** **ACRONYM: MICROKELVIN** **EC FUND: 4199988**

**DG:** RTD **Call: FP7-INFRASTRUCTURES-2008-1** **Thema:** INFRA-2008-1.1.1

**Title:** EUROPEAN MICROKELVIN COLLABORATION

**Abstract:** It is an unfortunate truth that the current electronics is facing a brick wall in a decade or so when Moore's law has finally run its course an no further miniaturization is possible. We need something new. Coherent electron circuitry may provide that entirely new alternative. In nanocircuits the electrons can behave coherently over the circuit dimension and thus follow the rules of wave motion rather than Ohm's law. To achieve coherence, however, electron scattering lengths must be larger than the sample size. That demands high purity to limit impurity scattering but even limiting thermal scattering by working at millikelvin temperature are still confined to circuits on the nanoscale. This provides the motivation for this application: there is an implicit imperative in nanoscience that there are enormous advantages to be gained at much

lower temperatures. Despite the clear demand, nanoscience in general is inhibited from advancing beyond the millikelvin regime by a lack of appropriate expertise and facilities. However, in Europe we already have the greatest concentration of microkelvin infrastructure and espertise in the world, developed by our quantum-fluids community. By integration and rationalization MICROKELVIN aims to put this existing infrastructure at the disposal of the wider communit y and together develope new techniques and materials to bring corerent structures into the completely new regime. Our ultimate aim is the creation of virtual European microkelvin "laboratory without walls" operating as a single entity. Integration will also allow us to pool our existing expertise and project it outword by greating new stand-alone machines able to access this temperature range anywhere. Such activity will also encourage European commercial interest in this opportunity. The infrastructure is there. The need is manifest. We simply have to bring the two together.

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**NBR: 228490** **ACRONYM: NANOBOND** **EC FUND: 1678871**

**DG:** RTD **Call: FP7-NMP-2008-SME-2** **Thema:** NMP-2008-4.0-7

**Title:** Integration of emerging soft nanotechnology into the functionalisation of textiles

**Abstract:** One key area of the European textile industry is the technical development of products and processes for reducing contamination and the removal of stains of all kinds from manufactured articles, including textiles. To a large part this is necessary for keeping up performance and function, often for health reasons, although sometimes this is for purely aesthetic effects. Thus, easy-to-clean, soil release and antimicrobial properties are linked aspects that are of great importance such: health and avoidance of cross-contamination in medical textiles; improvement in comfort and freshness in consumer apparel; reduction of spoilage or wastage during storage and transport; increase useful lifetime of articles. These benefits further contribute to the overall goal of sustainable product development, to save energy and to protect our water resources. As alternative to commonly used biocidal chemicals, we propose a new surface modification concept that can control surface microbial contamination, particularly the development of bacterial colonies and biofilms. Taking into account the needs of customers and environmental protection, the NanoBond Project aims to develop a new antimicrobial “soft nanotechnology” that comprises: •Adaptability to a wide range of consumer and industrial applications. •A responsive technology that adapts to the particular requirement for anti-microbial effect without “swamping” the environment with the un-restrained release of chemical antimicrobial agents, which is typical of other antimicrobial technologies. •Highly-tailored solutions by altering the characteristics of the polymeric nano-film. The NanoBond Project will exploit the “soft nanotechnology” to create nano-structured and functional surfaces that can impart multiple beneficial properties, or can act as a scaffold for the further incorporation of other performance

finishes. •Durability and effectiveness for the life of the goods. •Easy application and low application levels.

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**NBR: 228536** **ACRONYM: NEPHH** **EC FUND: 2428496**

**DG:** RTD **Call: FP7-NMP-2008-SMALL-2** **Thema:** NMP-2008-1.3-2

**Title:** NANOMATERIALS-RELATED ENVIRONMENTAL POLLUTION AND HEALTH HAZARDS THROUGHOUT THEIR LIFE-CYCLE

**Abstract:** The purpose of this project is to identify and rate important forms of nanotechnology-related environmental pollution and health hazards that could result from activities involved in nano-structures throughout their life-cycle, and to suggest means that might reduce or eliminate these impacts. Besides the positive multipurpose nano-reinforcement in materials and expanded devices applications, little is known about the environmental and health risks of certain manufactured nanomaterials. Initial research has indicated that nanomaterials can have a negative impact on human health and environmental pollution. For instance, carbon nanotubes may be more toxic than other carbon particles or quartz dust when being absorbed into the lung tissue; however, specific detailed research is required. More importantly, and fundamental to the success of nanotechnology, is the perceived safety of the technology by the public. As activity shifts from research to the development of applications, there exists an urgent need to understanding and managing the associated risks, but in particular to personnel working with these materials. To address these issues, an investigation of biological interactions of nanoscale and nanostructured materials on in vitro toxicological mechanisms is proposed. Further, an assessment of their impact on environmental pollution regarding water, soil and air is also proposed.

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**NBR: 228539** **ACRONYM: THEMA-CNT** **EC FUND: 2530750**

**DG:** RTD **Call: FP7-NMP-2008-SMALL-2** **Thema:** NMP-2008-2.1-2

**Title:** Thermal management with carbon nanotube architectures

**Abstract:** To overcome the difficulties in the contemporary thermal management of Si components and packages made of ceramics and organic laminates, in this project we propose novel and scaleable cooling technologies that utilize carbon nanotubes and their architectures integrated on various electrical components to achieve cooling efficiency of 100 W/m2 on large area Si chips, 10 W/cm2 on ceramics/polymer packages and 1 kW/cm2 on micro hot spots. Our efforts in the project are focused on generating specifically tailored nanostructured carbon based materials that are crucial for the

successful development of new thermal management technologies in current and future electronics. The technologies we are developing will enable direct integration of carbon nanotube architectures in electrical components and make a feasible protocol for upscaling for industrial use. As carbon nanotubes will be directly grown (and in some cases post-mounted) on Si chips/wafers and ceramic/plastic packages the process will be made compatible with conventional Si fabrication and micromodule packaging technologies, i.e. the technology would provide a ready protocol for large scale production of such components. Because of the compatibility with current technologies, the nanotube based cooling devices and production technologies will be cost effective and easy to commercialize. Since thermal management is the most crucial issue in today's high performance electrical devices (processors, power transistors) the market potential of our innovation is enormous exceeding several billion € total sales every year.

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**NBR: 228559** **ACRONYM: PROMINE** **EC FUND: 10999664**

**DG:** RTD **Call: FP7-NMP-2008-LARGE-2** **Thema:** NMP-2008-4.0-5

**Title:** Nano-particle products from new mineral resources in Europe

**Abstract:** The objectives of the ProMine IP address the Commission's concerns over the annual 11 billion € trade deficit in metal and mineral imports. Europe has to enhance the efficiency of its overall production chain putting higher quality and added value products on the market. ProMine focuses on two parts of this chain, targeting extractive and end-user industries. Upstream, the first ever Pan-EU GIS based mineral resource and advanced modelling system for the extractive industry will be created, showing known and predicted, metallic and non-metallic mineral occurrences across the EU. Detailed 4D computer models will be produced for four metalliferous regions. Upstream work will also include demonstrating the reliability of new (Bio)technologies for an ecoefficient production of strategic metals, driven by the creation of on-site added value and the identification of specific needs of potential end-users. Downstream, a new strategy will be developed for the European extractive industry which looks not only at increasing production but also at delivering high value, tailored nano-products which will form the new raw materials for the manufacturing industry. ProMine research will focus on five nano-products, (Conductive metal (Cu, Ag, Au) fibres, rhenium and rhenium alloy powders, nano-silica, iron oxyhydroxysulphate and new nano-particle based coatings for printing paper), which will have a major impact on the economic viability of the extractive industry. They will be tested at bench scale, and a number selected for development to pilot scale where larger samples can be provided for characterisation and testing by end-user industries. It will include production, testing and evaluation of these materials, with economic evaluation, life cycle cost analysis, and environmental sustainability. ProMine with 26 partners from 11 EU member states, has a strong

industrial involvement while knowledge exploitation will transfer ProMine results to the industrial community.

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**NBR: 228567** **ACRONYM: OOE-NIGHT** **EC FUND: 80000**

**DG:** REA **Call: FP7-PEOPLE-NIGHT-2008** **Thema:** FP7-2008-PEOPLE-NIGHT

**Title:** Upper Austrian Researchers' Night

**Abstract:** The Upper Austrian Researchers' Night aims to bring the most successful researchers closer to the public in the region of Upper Austria. During the OOE-NIGHT on 26.09.2008 around 60 researchers and scientists will present themselves and their research activities at six different locations in Linz - the capital of Upper Austria. The visitors will have the opportunity to take part in experiments, interactive games and demonstrations and lively discussions with researchers as well. The areas of topics presented range from robotics, art & media, social sciences, philosphy, theology to nanotechnology and many more.

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**NBR: 228573** **ACRONYM: NITLAB** **EC FUND: 28600**

**DG:** REA **Call: FP7-PEOPLE-NIGHT-2008** **Thema:** FP7-2008-PEOPLE-NIGHT

**Title:** A night in the lab

**Abstract:** The main aim of the present proposal is to bring researchers involved in biomedical research closer to the large public, without any distinction of age, gender, level of scientific training or social category. The proposed action intends to oppose the stereotypes about researchers and their profession, giving the opportunity to perceive them as “ordinary people”. On the other hand, in the last years, people have asked to biomedical researchers for more information about their work and the effect on public health. Therefore, showing a researcher “from inside”, stressing his/her “ordinary” features could help in attracting people to scientific careers and rise the perception of the role of researchers in our society . The proposal foresees the organization of a high impact event in the beautiful and ancient cloister of the University of Milan, giving an opportunity to young and adult people to meet researchers involved in biomedicine and nano-medicine, to see them at work and to work with them, taking part in real laboratory activities. Buffet, music and a drama show entitled “The day of a researcher” will create an informal and pleasant atmosphere. Local institution such as “Comune di Milano, Assessorato alla Salute” will support the event. Sophisticated instruments will also be shown and used during the laboratory activities. An “official” award ceremony will take place, during which the winners of the photo competition will receive a prize at

"Aula Magna" of the University of Milan. A representative of the Municipality of Milan together with a representative of the University of Milan will announce the winners and will describe the award foreseen by the Commission for the winner. The Commission is composed by photographic reviewers known at national and international level. The target audience of the event is very wide: from children up to aged people, e.g. all the ordinary people being part of the society.

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**NBR: 228579** **ACRONYM: TECHNOTUBES** **EC FUND: 5300000**

**DG:** RTD **Call: FP7-NMP-2008-LARGE-2** **Thema:** NMP-2008-4.0-3

**Title:** Technology for Wafer-scale Carbon Nanotube Applications

**Abstract:** Carbon nanotubes are materials with a set of unique electrical, mechanical, surface and thermal properties. Yet their adoption in mainstream applications has been limited by mass production and device integration. This project develops the first 300mm wafer-scale equipment for production of carbon nanotubes on surfaces. The project will cover the design, engineering, process control, quality assurance, qualification and process development. It will develop applications in cathodes for time resolved X-ray sources for X-ray tomography, cathodes for high power microwave amplifiers, interconnects for VLSI, thermal management surfaces, low stiction surfaces for micro-fluidic channels and filters, wafer scale fabrication of spin valve devices, and sensor surfaces for integrated sensors on CMOS.

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**NBR: 228581** **ACRONYM: ANASTASIA** **EC FUND: 3134676**

**DG:** RTD **Call: FP7-NMP-2008-SMALL-2** **Thema:** NMP-2008-2.4-2

**Title:** Advanced NAno-Structured TApeS for electrotechnical high power Insulating Applications

**Abstract:** The objective is to develop radically innovative electrical insulating tapes and process to improve the energy conversion efficiency of electrotechnical systems. It mainly addresses the electric power generation issue. Today, the energy conversion efficiency of generators is restricted by (i) thermal as well as (ii) electrical strength limitations due to the electrical insulator tapes themselves. The concepts of these multifunctional tapes are far behind the electrical insulating state of the art. The project aims to develop a new process chain leading to a drastic improvement of insulating tape structure homogeneity. The today's limitations of tape come from its heterogeneous multilayer structure bringing together very different materials like glass fibre fabric, mica flakes and polymers. Enabling this homogenisation requires higher performance materials, which

will be obtained by adjunct of inorganic nanofillers according to two proposed development routes: nanodielectrics polymer or inorganic polymers (sol-gel). This will lead to a more robust process chain with a better productivity (+50%) and an insulating tape with enhanced performances like a higher field strength (+40%), a better thermal conduction (+60%). At the end, a much thinner tape (-30%) enabling the design of more compact generators is expected. This project can strongly impact the energy production field. For instance at the European scale, a +0.2% gain in generator conversion efficiency could save the equivalent of one nuclear power plant of 1000 MW (1.5 billions €), or nearly 10 fossil fuel power plants and related reduction in CO2 emission. It will also affect other very large markets like the industrial motor field using similar insulation tapes. The consortium of ANASTASIA project is equally composed of industrials and research laboratories, namely two manufacturers (tape and power generator), two generator end-users, four academic laboratories and the CEA research institute as coordinator.

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**NBR: 228604** **ACRONYM: NANOMOF** **EC FUND: 5100000**

**DG:** RTD **Call: FP7-NMP-2008-LARGE-2** **Thema:** NMP-2008-2.4-1

**Title:** Nanoporous Metal-Organic Frameworks for production

**Abstract:** The discovery of porous hybrid materials constructed from inorganic nodes and organic multifunctional linkers has established a new area of inorganic-organic hybrids (Metal-Organic Frameworks, MOFs) with extraordinary performance as compared to traditional porous solids such as zeolites and activated carbon. “NanoMOF” will focus beyond discovery and integrate MOFs into products with industrial impact within a strong cooperation of established MOF research institutions and industrial end users. The extraordinary properties of MOFs are expected to lead to a significant ecologic and economic impact in three areas: 1) Clean air, pollution, and toxicity risks of gaseous chemicals are environmental concerns with specific materials needs for selective adsorption in porous materials and advanced filter systems. Industrial feed gases and exhaust gases require a high purity to ensure durable processes and avoid pollution. The integration of MOFs into textile products will be used to develop air permeable personal protective clothing. For industrial and house-hold fuel cell reformer units novel MOF-based sulphur removal systems will be developed. 2) Safe delivery of highly toxic electronic grade gases (etching gases, dopants) is crucial for tool operation in semiconductor and solar industry. 3) Catalysis is an ecologically relevant and economically attractive technology. The replacement of liquid acids by solid state catalysts avoids the production of toxic liquid waste. MOF catalysts for (trans)esterification processes are designed for the conversion of fatty acids and triglycerides into valuable products for the oleochemical industry. The integration of MOFs into industrial relevant processes and products is supported by advanced modelling, simulation and process monitoring techniques. The project aims for a higher

integration of MOFs into products with a high added value in order to propel Europe into an internationally leading position in the industrial use of MOFs.

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**NBR: 228622** **ACRONYM: MAGNIFYCO** **EC FUND: 3435956**

**DG:** RTD **Call: FP7-NMP-2008-SMALL-2** **Thema:** NMP-2008-1.1-1

**Title:** MAGNETIC NANOCONTAINERS FOR COMBINED HYPERTHERMIA AND CONTROLLED DRUG RELEASE

**Abstract:** The aim of this project is the assembly and the fabrication of a new generation of multifunctional nanostructures for performing combined hyperthermia and controlled drug release, specifically targeted to cancer cells. The “magnetic nanocontainers” we intend to develop can perform at the same time cell recognition, hyperthermia treatment, and, as a consequence of the heat and /or cell environment stimuli, the release of drug with high selectivity for ovarian carcinoma. These multifunctional tasks are made possible due to the inclusion of three main components: a) the magnetic nanoparticles, allowing detection by MRI, cancer treatment by hyperthermia and providing stimuli for drug release; b) the nanocontainers, which allow for drug encapsulation and protection from degradation, facilitate the release of the drug upon application of an external stimulus, such as heat, or an internal one, such as the acidic pH of the tumour cells; c) the antibody fragments attached to the surface of the magnetic nanocontainers to deliver them selectively to the ovarian cancer cells. The individual building blocks and their assemblies will be characterized with respect to physical, chemical, and biological features, followed by dissemination of the newly acquired knowledge. Cell culture experiments will allow to understand the performance of such nano-tools in vitro. Directed towards application in patients, in vivo animal studies will be carried out on the most successful magnetic nanocontainers. The objectives of this proposal cover a wide range of scientific fields, hence a truly interdisciplinary collaboration between chemists, physicists, and biologists is required. To this end, we propose a european network collaboration between academic partners, who will take care of the development of new solutions for nanofabrication, and industrial partners implied in the field of the proposed application who will evaluate/develop the materials and act as advisors for risks arising during the project.

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**NBR: 228625** **ACRONYM: INLIVETOX** **EC FUND: 2399989**

**DG:** RTD **Call: FP7-NMP-2008-SMALL-2** **Thema:** NMP-2008-1.3-2

**Title:** Intestinal, Liver and Endothelial Nanoparticle Toxicity Development and evaluation of a novel tool for high-throughput data generation.

**Abstract:** The InLiveTox project will form an interdisciplinary consortium at the European level, together with a key American research group to develop an improved in vitro model for the study of nanoparticle (NP) uptake, transport and cellular interaction, thus advancing our understanding of NP toxicity. Rather than repeat what has, or is being done in the field of aerosol NP and lung toxicology, InLiveTox will focus on the impact of NP exposure via ingestion, in the healthy and diseased gastrointestinal (GI) tract, vascular endothelium and liver. The key questions in this study are: (i) How do these tissues individually respond to NPs? (ii) How do the interactions between the different tissues modulate their responses? (iii) How does inflammation affect the toxicity of NPs and their ability cross the intestinal barrier? (iv) Which physico-chemical characteristics of NPs influence their uptake by intestinal epithelial cells and their subsequent interactions with endothelial and liver cells? The objective of InLiveTox will be to develop a novel modular microfluidics-based in vitro test system modelling the response of cells and tissues to the ingestion of NPs. Cell culture modules of target tissues such as the GI tract, the liver and the endothelium will be connected via a microfluidics system so that knock-on and cross talk effects between organs and tissues can be monitored. A major innovative aspect of the InLiveTox project pertains to the implementation of biological tissue models in a microfabricated compartmental cell culture system that allows multiple cell types to be addressed and investigated in combination. This system will be much easier, more convenient and ethically less questionable than animal testing, as well as more relevant than the in vitro single cell /co-culture models currently used. For this study, applications of the model will focus on NP toxicology, but the system could also be widely used in various applications of toxicology and pharmacology.

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**NBR: 228631** **ACRONYM: DOUBLENANOMEM** **EC FUND: 3000000**

**DG:** RTD **Call: FP7-NMP-2008-SMALL-2** **Thema:** NMP-2008-2.1-1

**Title:** Nanocomposite and Nanostructured Polymeric Membranes for Gas and Vapour Separations

**Abstract:** The main scope of the DoubleNanoMem project is the development of nanostructured membranes based on the most appropriate combination of nanofillers with well-defined size and porosity, dispersed in advanced high free volume polymers with inherent nanoporosity for application in specific gas and vapour separations. This approach is driven by the main requirement for successful replacement of traditional gas and vapour separation processes by membrane-based separations: a radical improvement of the permeability and selectivity compared to state-of-the-art commercially available membranes. The use of nanocomposite and nanostructured membrane materials is seen as one of the few approaches with the real potential to achieve this goal and in this

respect several combinations of polymers and nanoparticles will be tested. Different types of nanoparticles will be used, which are all able or have the potential to create preferential channels for mass transport: both single wall and multi wall carbon nanotubes, zeolites, mesoporous silicas and cucurbituril derivatives. The idea is to create a scientific basis for the combination of advanced polymers with suitable nanoparticles, compatible with the corresponding polymers, leading to membranes with unique separation properties. The principle targets of the project are: - Development of membranes with tailored separation performance based on innovative materials - Experimental characterization and development of structure-performance relationships. - Modelling of transport phenomena and of the material's structure to provide a better scientific understanding of gas and vapour transport phenomena and separation processes. - Applied research in a select number of consolidated and emerging areas of gas separation and pervaporation, such as CO2 separation from flue gas, natural gas processing, biofuel production. - Demonstration of the practical applicability of the developed principles and dissemination of the main achievements.

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**NBR: 228637** **ACRONYM: NIM_NIL** **EC FUND: 3373100**

**DG:** RTD **Call: FP7-NMP-2008-SMALL-2** **Thema:** NMP-2008-2.2-2

**Title:** Large Area Fabrication of 3D Negative Index Metamaterials by Nanoimprint Lithography

**Abstract:** Three-dimensional large area metamaterials, especially Negative Index Materials (NIMs) promise to enable numerous novel and breakthrough applications like perfect lenses and cloaking devices, not only but especially if they exhibit the desired properties in the visible frequency range. For the European Photonics industry it is of paramount importance enabling fabricating such materials as soon as possible, to maintain its important position in the areas of optical components and systems as well as production technologies. Till now such materials have not been produced, yet - neither in 3D nor on large areas, let alone both combined. The aim of NIM_NIL is the development of a production process for 3D NIMs in the visible regime combining UV-based Nanoimprint Lithography (UV-NIL) on wafer scale using the new material graphene and innovative geometrical designs. This project will go beyond state-of-the-art in three important topics regarding NIMs: the design, the fabrication using Nanoimprintlithography (NIL) and the optical characterization by ellipsometry. New designs and the new material Graphene will be investigated to extend the existing frequency limit of 900 nm into the visible regime. The fabrication method of choice is UV-NIL since it allows cost efficient large area nanostructuring, which is indispensible if materials like NIMs should be produced on large scale. The negative refraction will be measured using ellipsometry which is a fast and non-destructive method to control the fabrication process. At the end of the project a micro-optical prism made from NIM will be fabricated to directly verify and demonstrate the negative refractive index. Each aspect of innovation within NIM_NIL – design, fabrication and characterisation of NIMs – is represented by experts

in this field resulting in a multidisciplinary highly motivated consortium containing participants from basic research as well as industrial endusers from whole Europe.

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**NBR: 228652** **ACRONYM: SELFMEM** **EC FUND: 3599734**

**DG:** RTD **Call: FP7-NMP-2008-SMALL-2** **Thema:** NMP-2008-2.1-1

**Title:** Self-Assembled Polymer Membranes

**Abstract:** The aim of SELFMEM is to develop innovation in the field of nanoporous membranes. This will be achieved by taking advantage of the self-assembly properties of block copolymers leading to highly porous membranes with adjustable, regular-sized pores of tailored functionalities. Both polymeric and inorganic (silicon) membranes will be developed. In the case of isoporous polymeric membranes focus will be laid on the formation of integral-asymmetric block copolymer membranes with an isoporous top layer as a function of the block copolymer structure and the preparation conditions. Isoporous inorganic membranes will be prepared by using a thin block copolymer film as a mask for selective etching. The possibilities to systematically vary the pore size and density by varying the block copolymer mask structure will be investigated. The block copolymers will be synthesized by controlled polymerisation techniques (anionic, group transfer, and different radical polymerisations), depending on the chosen monomers. The characterisation during and after formation of the membranes will be carried out by light and various x-ray scattering techniques, by scanning force microscopy, and by different electron microscopic techniques. Both types of membranes will be post-functionalized in order to tune their final properties. The membranes will be tested for their applicability in different areas. Separation of gases (like H2/CO2) and proteins as well as water purification will be addressed in this project. Modeling and theory will support the understanding of the structure formation of these membranes and help to optimise membrane design. The results of SELFMEM will increase European competitiveness in strategic markets such as gas purification, water treatment and molecular biology. The consortium consists of 12 partners from 10 countries, including 4 companies from 3 countries.

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**NBR: 228664** **ACRONYM: EUROTALENTS** **EC FUND: 4996768**

**DG:** REA **Call: FP7-PEOPLE-2007-2-3-COFUND** **Thema:** PEOPLE-2007-2-3.COFUND

**Title:** Eurotalents: a European programme for transnational mobility of experimented researchers managed by CEA

**Abstract:** CEA is convinced that the ability of research institutes to offer attractive working conditions and career opportunities to researchers is a key factor in meeting the challenge of maintaining and boosting Europe's scientific and economic competitiveness. Thus, thanks to the European Commission cofunding, CEA would like to develop a centralised programme dedicated to researchers' transnational mobility and based on open merit competition and international peer review. This programme called 'Eurotalents programme' will aim at increasing the mobility of scientists and at offering a boost in their career thanks to the access to new research capacities. Eurotalents will open world class laboratories within CEA and abroad to researchers having an excellent scientific experience and wanting to broader their career via a research project in the scientific topic(s) of their choice within CEA well-known domains of expertise: (i) Energy, environment and climate change, (ii) Life sciences and biotechnology, (iii) Nanosciences and nanotechnologies, (iv) Science and technology of high performance computing, (v) High energy physics and physics of the universe. Eurotalents will thus offer fellowships to foreign researchers wanting to work in CEA (Incoming fellowships) or to French scientists aiming at developing their scientific career abroad (Outgoing fellowships). The selected researchers will also benefit from CEA network all over the world and have access to training courses in scientific and non scientific disciplines. Eurotalents will be directly operated by CEA that has already proved its capacity to efficiently manage European projects and national programmes according to strict rules Eurotalents will exploit synergies between UE actions, CEA research facilities and scientific environment, and CEA quality of work. Thus, Eurotalents will contribute to the success of the European Research Area by attracting third country researchers and promoting European mobility.

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**NBR: 228673** **ACRONYM: MAGNONICS** **EC FUND: 3499820**

**DG:** RTD **Call: FP7-NMP-2008-SMALL-2** **Thema:** NMP-2008-2.2-2

**Title:** Magnonics: Mastering Magnons in Magnetic Meta-Materials

**Abstract:** The opportunity to modify spectrum of excitations in materials with periodically modulated properties has stimulated striving research activity in the area of artificial periodic structures with aim to design novel materials with new revolutionary functionalities - so called meta-materials. Photonic, plasmonic, and phononic crystals and semiconductor superlattices are typical examples of exploitation of this concept for controlling light, acoustic wave and electron propagation and scattering in electronic and opto-electronic devices. Magnetic materials with periodically modulated properties are also known to possess properties that cannot be reduced to those of constituent layers. The best example here is the phenomenon of giant magnetoresistance (GMR), discovery of which was marked by the Nobel Prize Award last year. Importantly, the spectrum of magnons in periodic magnetic materials has band structure. By analogy to other band-gap materials, periodic magnetic structures used as a medium for controlled

propagation of magnons are called magnonic crystals, while the corresponding field of research is called magnonics. The objective of the proposed project is to bring together several European research teams with a broad of fabrication and characterization expertise in order to realize practically this new class of meta-materials – magnonic crystals. We will create 1D, 2D, and 3D magnonic crystals with dynamical magnetic properties tailored at the nano-scale. The created magnonic crystals will be then used to replace continuous magnetic materials within various devices ranging from electro-motors and actuators to nano-scale magnonic logic elements, in which magnons will be used as signal carriers. The experimental data obtained in the course of the project will be used to test existing and to create new theories of high-frequency magneto-dynamics in magnetic nano-structures.

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**NBR: 228685** **ACRONYM: BOND** **EC FUND: 2600000**

**DG:** RTD **Call: FP7-NMP-2008-SMALL-2** **Thema:** NMP-2008-1.1-1

**Title:** BIOELECTRONIC OLFACTORY NEURON DEVICE

**Abstract:** Recently, the use of smell in different fields has been rediscovered due to major advances in odour sensing technology and artificial intelligence. However, current electronic noses, based on electronic sensors, have significant limitations concerning sensitivity, reliability and selectivity, amongst others. These limitations are at the basis of recurrent troubles of this technology to reach essential applications in different areas, such as food safety, diagnosis, security, environment… The present project proposes a new bioelectronic nose based on olfactory receptors in order to mimic the animal nose. For this aim, micro/nano, bio and information technologies will converge to develop an integrated bioelectronic analytical nanoplatform based on olfactory receptors for odour detection. Briefly, the basis of the nanobioplatform will be the olfactory receptors, prepared in the form of nanosomes immobilized onto the nanotransducers (NANO and BIO). An array of smart nanotransducers will acquire and process electronically the detected odour (NANO and INFORMATION). Such an easy-to-use nanobioplatform, with user-friendly interface and odorant identification algorithm, will detect and discriminate the odorants (NANO and INFORMATION). The scientific and technological challenges of the BOND project can only be solved by integrating a multidisciplinary consortium at European level with expertise in areas such as biotechnology, surface chemistry, nanofabrication, electronics and theoretical modelling. The partners involved in the BOND project are experienced partners used to work in large consortia with distributed laboratories all over the European Union and offer competences and resources to build a complementary partnership for the successful implementation of the nanobioplatform. Six of the eight partners have already successfully worked together in the European SPOT-NOSED project to produce a proof of concept of a bioelectronic sensor based on olfactory receptors

**NBR: 228686** **ACRONYM: LIGHT-ROLLS** **EC FUND: 3748323**

**DG:** RTD **Call: FP7-NMP-2008-SME-2** **Thema:** NMP-2008-3.5-1

**Title:** High-throughput production platform for the manufacture of light emitting components

**Abstract:** Light-Rolls focus on research and development of modular based production units for the seamless, high throughput manufacture of micro-structured, polymer based components and Microsystems. The scientific objective aims to realize structures in the micron range and integrate also Dies, smaller then 0,5mmx0,5mm and thickness down to 50 um to be assembled in high-speed. Nanopar-ticulate dispersions used in fast conductive track printing technologies will allow the parallel gen-eration of conductive lines down to 30µm track width. Light-Rolls is based on highly innovative manufacturing and assembly technologies: 1. RMPD®-rotation, a patented process technology, which uses a UV curable liquid to generate polymer structures (generative manufacturing approach). 2. New chip assembly methods, originating from self assembly methods 3. High resolution – high speed conductive track and interconnection generation by ink-jet printing methodologies. These processes comprise the founding elements of the Light-Rolls technology platform with a roll-to-roll philosophy. The manufacturing modules will be integrable, exchangeable, with mechanical, fluidic and IT interfaces, to make it easy and cost efficient to adjust the sequence of process steps to the product to be produced. Besides the translation of processes for high-throughput manufacturing, high yield will be achieved by the application of advanced process control and production IT meth-ods. Lines run without dangerous chemicals and use integrated recycling. For future products a Light-Rolls knowledge base for design for manufacturing will be elaborated. A pilot line will be set-up, tested for fabrication of flexible LED-display systems. Manufacture of other components like Lab-on-Chip or integration of new micro-energy storage components is possible in future to address needs of European industry. Products have potential of 100 Mio Euro worth revenue for 1 partner alone for a 5 year period beyond project end.

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**NBR: 228701** **ACRONYM: NASA-OTM** **EC FUND: 3200363**

**DG:** RTD **Call: FP7-NMP-2008-SMALL-2** **Thema:** NMP-2008-2.1-1

**Title:** NAnostructured Surface Activated ultra-thin Oxygen Transport Membrane

**Abstract:** The main objective of the proposed project is the development and industry-driven evaluation of highly stable and highly oxygen-permeable nano-structured oxygen transport membrane (OTM) assemblies with infinite selectivity for oxygen separation

from air. The new approach proposed to reach this objective is the development of ultra thin membrane layers by e.g. CVD, PVD or Sol-Gel techniques with catalytic activation of the surfaces. This approach is supposed to make available highly stable membrane materials, which are currently out of discussion as the oxygen permeation measured on thick membranes is too low. Sufficiently high oxygen fluxes shall be obtained by (i) ultra thin membrane layers on porous supports to minimize diffusion barriers; (ii) catalytic surface activation to overcome slow surface exchange/reaction kinetics; and (iii) thin-film nano-structuring, generating new diffusion paths through the grain boundaries in a nano-crystalline matrix. The membrane development is supported by thermo-mechanical modelling as well as atomistic modelling of transport properties. The produced oxygen is provided to Oxyfuel power plants or chemical processes such as oxidative coupling of methane (OCM) to higher hydrocarbons or HCN synthesis, which will contribute in a way to the mitigation of CO2 emissions. Oxyfuel power plants combust fuels using pure oxygen forming primarily CO2 and H2O making it much easier and cheaper to capture the CO2 than by using air. The major advantages of OTM are significantly lower efficiency losses than conventional technologies and the in principle infinite oxygen selectivity. OCM produces higher hydrocarbons directly without forming CO2 and HCN synthesis can be improved by process intensification resulting in energy and subsequent CO2 savings.

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**NBR: 228730** **ACRONYM: SONO** **EC FUND: 8300000**

**DG:** RTD **Call: FP7-NMP-2008-LARGE-2** **Thema:** NMP-2008-1.2-1

**Title:** A pilot line of antibacterial and antifungal medical textiles based on a sonochemical process

**Abstract:** Hospital-acquired (nosocomial) infections are a major financial issue in the European healthcare system. The financial impact of these infections counteract medical advances and expensive medical treatments by increasing the length of hospital stay by at least 8 days on average per affected patient, hence adding more than 10 millions patient days in hospitals in Europe per year. The statistics on patient safety in the EU show alarming tendencies : - 1 in 10 patients are affected by hospital-acquired infections - 3 million deaths are caused by hospital-acquired infections An active infection control program of patients and personnel and hygiene measures, have proven to significantly reduce both the number of infections and hospitalisation costs . The SONO project directly addresses the above problems by developing a pilot line for the production of medical antibacterial textiles. The pilot line will be based on the scale-up of a sonochemical process developed and patented at BIU laboratories. The pilot line will use a sonochemical technique to produce and deposit inorganic, antimicrobial nanoparticles on medical textiles, e.g. hospital sheets, medical coats and bandages. Sonicators are used industrially for heavy and light duty cleaning, for water disinfection and for sewage treatment. It is also used in the food industry for emulsification and drying. The

proposed concept based on one step sonochemical process to produce nanoparticles and impregnate them as antibacterial factors on textile is novel and does not exist on an industrial scale. The concept has already been proven (and patented ) on a lab scale where sonochemistry was applied to impregnate nanoparticles in a single-step process. It was demonstrated that due to the special properties of the sonochemical method the antibacterial nanoparticles are adsorbed permanently on the fibres even after 70 “laundry cycles”. The sonochemical impregnation process is a one-step procedure in which the nanopa

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**NBR: 228743** **ACRONYM: NOVA-CI(G)S** **EC FUND: 3474727**

**DG:** RTD **Call: FP7-NMP-2008-SMALL-2** **Thema:** NMP-2008-2.4-2

**Title:** Non-vacuum processes for deposition of CI(G)S active layer in PV cells

**Abstract:** Current production methods for thin film photovoltaics typically rely on costly, difficult to control (over large surfaces) vacuum-based deposition processes that are known for low material utilisation of 30-50%. NOVA-CI(G)S proposes alternative, non-vacuum ink-based simple and safe deposition processes for thin film CI(G)S photovoltaic cells. The low capital intensive, high throughput, high material yield processes will deliver large area uniformity and optimum composition of cells. The project objectives are to achieve competitive about 14% small area cell efficiency and to demonstrate the processes at high speed on rigid and flexible substrates while maintaining acceptably high efficiencies. The processes reduce cost of the CI(G)S layer by 75-80% in comparison to the evaporated CI(G)S, which translates into a 20-25% reduction of total module cost. Major scientific breakthroughs of the project include improved materials control in novel precursor materials by using nano-sized particles of specific chemical and structural characteristics and innovative ink formulation, to enable coating by simple processes while avoiding the use of toxic gases in subsequent process steps. This industry-led project constitutes the first essential step for a fully non-vacuum, roll-to-roll process aimed to achieve the solar module production cost below 0,8 €/Wp that will make photovoltaic directly competitive to traditional energy generation.

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**NBR: 228762** **ACRONYM: METACHEM** **EC FUND: 3699990**

**DG:** RTD **Call: FP7-NMP-2008-SMALL-2** **Thema:** NMP-2008-2.2-2

**Title:** Nanochemistry and self-assembly routes to metamaterials for visible light

**Abstract:** The objective of the METACHEM collaborative project is to use the extreme versatility of nano-chemistry to design and manufacture bulk meta-materials exhibiting non-

conventional electromagnetic properties in the range of visible light. This spectral domain requires nano-scale patterns, typically around 50 nm in size or less. Our strategy consists in designing and synthesizing ad-hoc nano particles as optical plasmonic nano-resonators and organising them through self-assembly methods in 2 or 3 dimensional networks in order to produce dense highly ordered structures at a nano-scale level. Several subprojects corresponding to different routes are proposed, all of them based on existing state-of-the-art chemical and self assembly methods. In addition, the important issue of losses inherent to the plasmonic response of the nano-objects is addressed in an original way by the adjunction of loss-compensating active gain media. A special effort is made on the difficult measurement of the non conventional meta-properties as they constitute the first demonstration of the validity of the concept. A technological and an industrial point are added towards the search of efficient, cost-effective and industrially feasible metamaterials. The key point of the METACHEM project joining 9 partners from 7 European states is that it brings together for the first time European experts of three complementary fields namely nanochemistry, self-assembly methods and metamaterials science. The majority of the partners are members of FP7 virtual institutes related to these fields i.e. respectively EMMI, SOFTCOMP and METAMORPHOSE II. Main goals: Design and synthesize optically isotropic meta-materials with exotic and extreme properties realized by simple and cheap chemical methods. Target properties: artificial optical magnetic and dielectric properties, optical left-handed materials, near-zero permittivity/permeability; negative index materials, low-loss plasmonic structures.

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**NBR: 228789** **ACRONYM: ENPRA** **EC FUND: 3700000**

**DG:** RTD **Call: FP7-NMP-2008-SMALL-2** **Thema:** NMP-2008-1.3-2

**Title:** RISK ASSESSMENT OF ENGINEERED NANOPARTICLES

**Abstract:** Engineered Nanoparticles (ENP) are increasingly produced for use in a wide range of industrial and consumer products. Yet it is known that exposure to some types of particles can cause severe health effects. Therefore it is essential to ascertain whether exposure to ENP can lead to possible health risks for workers and consumers. We have formed a consortium of well-known scientists from European Universities and Research Institutes, with over 100 publications in the field of Nanotoxicology. Our aim is to develop an approach for the Risk Assessment of ENP (ENPRA). Our objectives are: (i) to obtain a bank of commercial ENP with contrasting physico-chemical characteristics and measure them; (ii) to investigate the toxic effects of ENP on 5 (pulmonary, hepatic, renal, cardiovascular and developmental) target systems and 5 endpoints (oxidative stress, inflammation; immuno-toxicity; fibrogenecity; genotoxicity) using in vitro animal/human models; (iii) to validate the in vitro findings with a small set of carefully chosen in vivo animal experiments; (iv) to construct mathematical models to extrapolate the exposure-dose-response relationship from in vitro to in vivo and to humans; (v) to

use QSAR like models to identify the key ENP characteristics driving the adverse effects; (vi) to implement a risk assessment of ENP using the Weight-of-Evidence approach; (vii) to disseminate our findings to potential stakeholders. To harmonise the research activities between our EU group and the US, we have established links with scientists from US Universities (Duke, Rochester) and Government Agencies (NIH/NIEHS, NIOSH and EPA) with on-going research in Nanotoxicology. Our objectives here are (vii) to share information and agree on experimental protocols; (viii) to avoid duplication of work; (ix) to further validate the findings of this proposed study.

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**NBR: 228802** **ACRONYM: SUNPAP** **EC FUND: 6765000**

**DG:** RTD **Call: FP7-NMP-2008-LARGE-2** **Thema:** NMP-2008-1.2-1

**Title:** Scale-Up Nanoparticles in Modern Papermaking

**Abstract:** Past years have made the radical change of the European paper industry evident to everyone. To accelerate growth, the industry has to beat the product commoditization and renew its product base with value-added products. Energy saving is not just part of the environmental agenda, it has become the most crucial topic for the competitiveness of European paper industry. In order to maintain the advantage, the development of technologically advanced manufacturing processes is a must, along with reduced specific energy consumption. Nanocellulose is the most promising nano-material for wide-variety applications in papermaking, today only prepared and applied in lab-scale. SUNPAP addresses the enhancement of European paper industry competitiveness by means of nanofibrillouscellulose (NFC) based processes. SUNPAP proposes a program based on an integrated and complementary approach for: a) scaling up efficient and innovative production routes to deliver nanofibrillous cellulose (NFC) as functional additive for industrial processes and innovative added value products; b) innovating the papermaking processes by the introduction of NFC additive; c) assessing impacts of nanotechnologies on consumer and occupational safety, public health in general and environment, and enhancing the related European foreground d) demonstrating the economic, environment and social sustainability of the innovative papermaking processes and products and therefore, e) successfully transferring the nanotechnology innovation to the paper value chain. Through demonstrations of the processes, the project will deliver new extremely light-weight and multifunctional products for a wide range of end-uses in the graphical and packaging paper industries. Economical and sustainability assessments in the project cover the whole value chain. However, the targeted advantages are not possible without dramatically changing the total value chain, encompassing it from the pulp to the end of life-cycle of the product

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**NBR: 228814** **ACRONYM: SUPERSONIC** **EC FUND: 4600000**

**DG:** RTD **Call: FP7-NMP-2008-LARGE-2** **Thema:** NMP-2008-4.0-3

**Title:** SUPERSONIC DEPOSITION OF NANOSTRUCTURED SURFACES

**Abstract:** The basic scientific and technological concept of the project is to use agglomerated nanophased powders to be transferred onto a substrate in the form a coating with very little or none change of crystal structure. This will allow to obtain nano-structured coatings with a crystal size very close to the powder one. The concept will be extended to an important breakthrough concept that is the “Supersonic deposition of nanostructured surfaces” using multifunctional “reactive” aggregated nanopowders for coating deposition: the residual chemical energy stored inside the material (uncompleted chemical reactions) can be developed during the deposition to assist deformation effects and contributing to bond together particles onto the substrate via creep/liquid phase sintering mechanisms. Many different systems will be explored pertaining to the aeronautical, mechanical and biomedical fields. The main S/T objectives of the project are: • Materials design of based on performance requirements; • Development of agglomerated (typically 20-50 microns size) nanophased powder classes (crystal sizes 10-20 nm) suitable for deposition using cold spraying containing either solid lubricants and/or residual chemical enthalpy in proper metal matrix; • Cold spraying process development for the “reactive” deposition (wide range of adds in temperature), and self lubricating nanostructured coatings (synthesis of "new" nanocomposite materials); • Development of three classes of nanostructured coatings for very relevant tribological applications (with self lubricating properties, abrasion and fretting resistance, biocompatibility) which suffer from a complete lack of solutions in the fields of bearings, machines parts and medical devices; The above objectives relates perfectly to the call content since it is intended to develop: novel nanostructured coatings; improved wear behaviour; chemical inertness; new generation of solid lubricants and tribological materials

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**NBR: 228815** **ACRONYM: NANOMICRO** **EC FUND: 3900000**

**DG:** RTD **Call: FP7-NMP-2008-SME-2** **Thema:** NMP-2008-3.5-1

**Title:** NANO/MICRO INTEGRATION IN MICROMANUFACTURING

**Abstract:** The new high productive platform for 3D main objective of NANOMICRO project is to provide the manufacturing industry with an entirely nanomicromanufacturing platform, by way of a new micron scale resolution and an innovative direct parallel-deposition process. The process will be able to deliver a layer wise manufacturing approach using highly focalized powder/heat fluxes, with dimensions in the micron range. This will allow to control spatial resolution within the same limit and building up parts with such extreme control of the (fully dense) bulk materials. The S/T objectives of the project will

provide: -several submicron powder grades as aggregates of nanocrystals; -implementation of highly localized powder fluxes to drive high accuracy object fabrication, on the scale of better than 5 µm; -online monitoring allowing combinations of accuracy and productivity to be achieved at which the technology will become a new production tool, for 3D metal parts integrating nanostructures; -High-precision and High-production (HP2) micro-manufacturing deposition strategies; -multimaterial (gradient) deposition using different powder types on the same layer; -integrated materials and component ecodesign; -nano(micro)manufacturing principles by allowing integration of nanoscale structures first at powder level (micron agglomerates) and then at 3D part level (mm); -HP2 microfabrication station capable of enhanced accuracy and faster micro-objects deposition (typically 1x1 mm/each) by using single laser sintering head or microwave parallelized multi- sintering heads; -Make the developed machine available for exploitation primarily within the EU manufacturing industry. NANOMICRO project fully responds to the call topic extending the microfabrication process capabilities by encompassing a wider range of innovative materials and geometric shapes, satisfying functional and technical requirements, allowing the emerging of new microproducts in many technological fields.

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**NBR: 228825** **ACRONYM: HINAMOX** **EC FUND: 2297337**

**DG:** RTD **Call: FP7-NMP-2008-SMALL-2** **Thema:** NMP-2008-1.3-2

**Title:** Health Impact of Engineered Metal and Metal Oxide Nanoparticles: Response, Bioimaging and Distribution at Cellular and Body Level

**Abstract:** Metal oxide and metal NPs are particularly dangerous for two reasons: their special catalytic activity coming from the properties of their nanointerface may interfere with numerous intracellular biochemical processes and the decomposition of NPs and the ion leakage could heavily interfere with the intracellular free metal ion homeostasis, which is essential for cell metabolism. A very specific problem is the difficulty of localizing and quantifying them in cells. Obtaining dose effect relationships is not simple, because of the unknown amount of material present in affected cells. The following main points will be addressed in this proposal:1) Design and synthesis of metal oxide and metal NPs, which can be traced by SPECT, PET, and fluorescence techniques and the appropriate characterization of these NPs.2) Application of label-free techniques, such as IBM and EM to ensure that the radioactive and fluorescent constituents do not modify the cytological and organismic response by themselves.3) Characterization of the uptake, distribution kinetics and NP release at the level of the organism.4) Study of the interaction of NPs with plasma components forming complexes with NPs and the assessment of their possible impact on the uptake compared with that of bare or capped particles.5) Quantification and localization of metallic NPs in immune competent cells is a key task for the establishment of proper dose-response correlations. A technique applicable with living cells as ultimate control will be IBM, capable of

detecting single metal NPs in cells at different depths.6) Development of sophisticated cell physiological approaches focusing on the determination of oxidative activity, cytokine production and adaptive processes concerning signalling pathways beyond standard vitality tests. The research project will indicate toxic levels of various NPs and sub-toxic effects will be investigated by analysing the signalling response of immune cells

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**NBR: 228827** **ACRONYM: NANOFOL** **EC FUND: 5149874**

**DG:** RTD **Call: FP7-NMP-2008-LARGE-2** **Thema:** NMP-2008-4.0-1

**Title:** Folate-based nanobiodevices for integrated diagnosis/therapy targeting chronic inflammatory diseases

**Abstract:** NANOFOL proposes to develop a new diagnostic/therapy approach using folate based nanobiodevices (FBN) able to provide a new type of cost efficient treatment for chronic inflammatory diseases such as Atherosclerosis and Rheumatoid Arthritis with low side effects that will constitute a more advantageous solution than current therapies. NANOFOL will achieve all that by fulfilling the following objectives: •Design , development and production of nanobiodevices (FBN) targeting directly effector cells •Proof of concept in vitro and in vivo of a folate based nanodevice targeting activated macrophages in chronic inflammation not affecting bystander cells •Proof of concept in vitro and in vivo of a nanodevice containing a bispecific antibody (against folate receptor and another macrophage marker) targeting activated macrophages in chronic inflammation not affecting bystander cells •Proof of concept of FBN delivery therapeutic agents (by small interfering ribonucleic acid molecules (siRNA) or lipophylic molecules) targeting inflammatory signaling pathways •In vitro and in vivo testing of cellular toxicity caused by the novel nanobiodevices in cells other than activated macrophages •Design of models that will enable to minimize animal experimentation. •Development of a strategy to assess potential risks in order to ensure nanobiodevice safe delivery. NANOFOL has adopted a specific risk strategy to attain objectives in a step by step approach allowing improving gradually the concept (specificity, stability, side effects efficacy) from the lower to the higher risky solutions ensuring reduced experimental animal testing and high human safety. The NANOFOL project will combine expertise in nanotechnologies, biology, chemistry, materials science, biotechnology, engineering, risk analysis, medical and pharmaceutical sciences.

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**NBR: 228844** **ACRONYM: NANOBIOTOUCH** **EC FUND: 3744590**

**DG:** RTD **Call: FP7-NMP-2008-SMALL-2** **Thema:** NMP-2008-1.1-1

**Title:** Nano-resolved multi-scale investigations of human tactile sensations and tissue engineered nanobiosensors

**Abstract:** The main scientific aims are to radically improve understanding of the human mechanotransduction system and tissue engineered nanobiosensors. This will be achieved through systematic integration of new developments from converging scientific areas by involving academic and industrial participants who are experts in cognitive sciences, microneurography, brain imaging, cell biology and mechanics, tissue engineering, skin physics (tribology and mechanics), microengineering, multi-scale multi-physics modelling, information processing, robotics, prosthetics and medical rehabilitation. The project will build on existing discriminative touch research in order to understand affective touch mediated by the human fingerpad. Sensors capable of detecting directional force and temperature will be developed since a combination of these modalities is critical to the affective component of the neurophysiological response evoked in taction. This next generation of sensors will include NEMS arrays and hybrid bio-NEMS systems. They will be integrated into a robotic finger with articulation controlled by neural network information processing that will allow artificial exploration of a surface to be achieved in ways that mimic human haptic behaviour and affective response. The impact of the project will include alleviating the effects of human touch and vision disabilities, improving the quality of life, security printing, brand protection, smart packaging, space exploration and also the evaluation of products such as textiles and skin creams using the instrumented robotic finger. The consortium includes industrial participants who will undertake specific technical exploitation activities in order to maximise the commercial impact of the research.

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**NBR: 228869** **ACRONYM: MATRANS** **EC FUND: 3600000**

**DG:** RTD **Call: FP7-NMP-2008-SMALL-2** **Thema:** NMP-2008-2.5-1

**Title:** Micro and Nanocrystalline Functionally Graded Materials for Transport Applications

**Abstract:** MATRANS aims at development of novel metal-ceramic functionally graded materials (FGMs) for aerospace and automotive applications in: (i) exhaust and propulsion systems, (ii) power transmission systems, and (iii) braking systems, with the main objective to enhance the mechanical properties of these materials through spatial variations of material composition and microstructure. Specifically, MATRANS deals with two groups of bulk FGMs: (i) ceramics-copper/copper alloys, (ii) ceramics-intermetallics. These FGM systems have not yet been used in the transport sectors targeted. The MATRANS methodology is problem oriented and comprehensive combining interrelated activities of material processing (core activity of the project), characterisation, modelling and demonstration. The processing will encompass starting materials (e.g. nanopowders) and the resulting FGMs. Characterisation of the FGMs will include detailed description of microstructure, measurements of physical and mechanical

properties and residual stresses. The modelling will be carried out at a design phase and for the material response to combined thermomechanical loading and extreme service conditions. Extensive use of multiscale approaches and numerical methods will be made. The project addresses the joint design of the FGM and the structural component it is intended for. Economical and ecological aspects of processing are included. Risks aspects of material non-performance will be tackled, too. MATRANS has mobilized a critical mass of interdisciplinary expertise and highly specialized equipment. The consortium includes leading groups from materials science, physics, chemistry, mechanical engineering and computer science. The industry and SME involvement in the project is substantial. As the exploitation measures, the industrial partners will define business plans and start pilot cases during the project, followed by upscaling activities after the project end.

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**NBR: 228882** **ACRONYM: NANOHEX** **EC FUND: 6099582**

**DG:** RTD **Call: FP7-NMP-2008-LARGE-2** **Thema:** NMP-2008-1.2-1

**Title:** Enhanced Nano-fluid Heat Exchange

**Abstract:** Henix will translate promising laboratory based nanotechnology results into pilot lines for the production of nanofluid coolants. This project, conceived and led by its European industrial partners, is designed to improve the competitiveness of European industry by developing new and more efficient cooling technologies and processes; specifically a new, state of the art, nanofluid coolant with a significantly enhanced technological capabilities that will transform the design and performance of thermal management systems. Nanofluid coolants represent a new exploitation of nanotechnology that has only become possible as a result of recent advances in nanoparticle production and dispersion technology. The beneficial adoption of nanofluid coolants usually requires re-design of the whole system including heat exchangers, pumps, pipe work and operating points. The gains come from a subtle re-balancing of the pump power, heat losses, plant cost and thermal efficiency. Flow regimes and the geometry of cooling channels play a key role. Understanding how to design systems to realise these benefits is a bottleneck to industrial adoption of nanofluids coolants. The mechanism of how heat transfer is facilitated by nanoparticles in carrier fluids is not clearly understood by the global research community. Analytical Models as yet do not fully explain and predict the thermal performance of nanofluid coolants. The advancement of this knowledge will enable engineers to readily design heat systems using nanofluid coolants. The most promising application opportunities for nanofluid coolants reside in large information data centres containing computer servers and racks, power electronics and power electronics for electric drives. The project will stimulate and accelerate the industrial take-up of nanofluid coolants used to innovate next generation heat exchangers to more effectively cool equipment and machinery, significantly reducing energy consumption and costs by up to 50%.

**NBR: 228885** **ACRONYM: ADVANCE-FSP** **EC FUND: 3080926**

**DG:** RTD **Call: FP7-NMP-2008-SMALL-2** **Thema:** NMP-2008-2.1-2

**Title:** LARGE SCALE PRODUCTION OF TAILORED NANO-OXIDES BY ADVANCED HIGH-OUTPUT, HIGH-VERSATILITY FLAME SPRAY PYROLISIS

**Abstract:** The aim of the project Advance-FSP will be the design and construction of a prototype industrial FSP nanoparticle production line, one order of magnitude higher than whatever is currently available, suitable to achieve at a continuous and trouble-free production level of 5kg/h the same results regarding nature and size (in the range of 10nm) of nanoparticles as obtained in the small FSP laboratory reactors currently used, validating the technology developed by the production in industrial operating conditions of 10 kg of ZrO2, 10kg of CeO2, 20kg of CeO2/ZrO2 in different proportions, 5kg of Pd/CeO2/ZrO2 and 1.5kg of Pt/CeO2/ZrO2. The fundamental problem in up-scaling the FSP technology from laboratory to industrial level is the fact that for larger productions an increase in feed rate and/or precursor concentration are required, both resulting in the formation of nanoparticles with bigger diameters. The production line reactor will be carefully design, followed by the optimisation of operating parameters such as concentration of the precursor, precursor feed rate, dispersion gas flow rate and spray conditions, and the introduction of additional quenching systems and multi-burner strategies. Therefore, the project will take an approach based on subsequent incremental up-scaling processes, first to productions of 100g/h, second to 500 g/h and subsequently to 5 Kg/h, heavily relying on on-line measurements during FSP synthesis of temperature fields (FTIR), concentration of precursor species in the different flame fields (FTIR), evolution along the flame of the particle size and degree of agglomeration (thermophoretic extraction and TEM) and definition of velocity fields within FSP reactor (phase Doppler anemometry) combined with computational Fluid Dynamics Simulations able to predict for FSP reactions the flow, temperature and specification fields, spray conditions, combustion dynamics and particle evolution, including particle formation, growth, etc.

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**NBR: 228916** **ACRONYM: NOMS** **EC FUND: 2549965**

**DG:** RTD **Call: FP7-NMP-2008-SMALL-2** **Thema:** NMP-2008-1.1-1

**Title:** NANO-OPTICAL MECHANICAL SYSTEMS

**Abstract:** Nano-optical mechanical actuation based on nanotube-enriched polymeric materials is a much sought-after technology. In this scheme, light sources promote mechanical

actuation of the polymeric materials producing a variety of nano–optical mechanical systems such as tactile displays, artificial muscles, and nano-grippers among others. The purpose of the NOMS project is to fabricate microsystems capable of light-induced mechanical actuation. In particular, the team proposes to build a visual-aid tablet for the blind or partially-sighted. Accomplishing this ambitious project requires knowledge of basic and integrating research within the field. It also requires the contribution of expert neuropsychologists to study, in cooperation with end-users, the effectiveness of the tablet both as an assistive tool for the visually impaired and as a research tool in the field of neuropsychology. The consortium is formed by experts in the areas of materials, optics, microsystems, neuropsychology, as well as end users, who will fabricate the first visual aid tablet. This well-balanced team possesses a unique combination of talent to guarantee achievement of the project objectives. The NOMS approach ensures that a solution (photo-actuated nanomaterials) will be provided to a particular problem (fast-refreshed portable visual-aid devices). NOMS will provide tactile screens for the visually impaired to read complex visual representations such as mathematical equations and graphical images. Everyday activities of such individuals will be greatly improved by including these devices in ATMs, personal computers, mobile telephones etc. This project is visionary with respect to some of the mainstream R&D directions, offering European industry a competitive advantage in the assistive technology marketplace worldwide. Appropriate industrial partnerships with adequate technology transfer experience have been included in the consortium with the purpose of thorough exploitation of the technology.

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**NBR: 228929** **ACRONYM: NANODIARA** **EC FUND: 8917307**

**DG:** RTD **Call: FP7-NMP-2008-LARGE-2** **Thema:** NMP-2008-4.0-1

**Title:** Development of novel nanotechnology based diagnostic systems for Rheumatoid Arthritis and Osteoarthritis

**Abstract:** Based on the clinical unmet needs and recent research in biomarkers on Rheumatoid Arthritis (RA) and Osteoarthritis (OA) the main objective of the project is to develop a nanotechnology based novel diagnostic tool for easy and early detection of biomarkers in inflammatory diseases especially RA and OA by using modified superparamagnetic nanoparticles (SPION) for (A) bioassay (ex-vivo application) and (B) MRI (in-vivo detection). A new technology based on multiple functionalized single nanoparticles specifically entering/attaching to cells, to enzymes in serous fluids or organelles in living cells will be used to detect, separate and identify low abundance biomarkers. Newly identified biomarkers will be used to decorate SPION with binding moieties which are specific to the biomarker(s) and can be used diagnostically such as in contrast agents (MRI). A sensitive micro-immunoassay will be developed for special use of these particles in biochemical tests for arthritis. This project is driven by the high clinical need to identify early arthritis and then segment RA and OA patients into

progressors/responders or non-progressors/-responders to various treatment options. Inflammatory disorders like RA inducing the destruction of cartilage in ≈ 1% of the population which is accompanied by significant pain, morbidity and mortality leads to reduced capacity to work. OA, a degenerative arthritis is the leading cause of disability among the elderly population. As there is no cure for RA and finally the replacement of e.g. the knee in OA, early diagnostic tools for the detection of the disease progression and the ability to evaluate the efficacy of therapeutic interventions are necessary u.a. for drug development. Existing diagnostic methods often do not permit an early definite diagnosis, so new nanoparticle based diagnostic techniques targeting to the detection of molecular events (based on MRI) with higher sensitivity/specificity will be developed to satisfy the urgent need.

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**NBR: 228933** **ACRONYM: VIBRANT** **EC FUND: 8073000**

**DG:** RTD **Call: FP7-NMP-2008-LARGE-2** **Thema:** NMP-2008-4.0-1

**Title:** In Vivo Imaging of Beta cell Receptors by Applied Nano Technology

**Abstract:** Currently, around 30 million people in the enlarged Europe suffer from diabetes, with a prevalence of 7.5% in member states. In recent years the emergence of type 2 diabetes in children and adolescents is a new and serious health challenge to the youth of Europe, their families and society. By 2025, the number of people with diabetes is expected to rise to around 50 million in Europe, thus increasing prevalence to 10.9%. This devastating disease is ranked among the leading causes of fatal cardiovascular diseases, kidney failure, neuropathy, lower limb amputation and blindness. Estimates of annual direct cost of diabetes care in Europe are currently EUR 50 billion. The indirect costs of diabetes i.e. the cost of lost production are as high as direct costs or even higher. Diabetes results from an absolute or relative decline in pancreatic β-cell function and/or mass. Although of ultimate importance for diabetes management and the development of new therapies, hitherto, no clinically established methodology for non-invasive in vivo imaging and quantification of β-cell mass (BCM) exists. VIBRANT proposes superparamagnetic fluorous phase nanocontainers (FPNC), which are functionalized with β-cell specific ligands for in vivo MRI. This combines β-cell specific targeting with the unrivalled MRI sensitivity of supermagnetic particles and the high resolution power of 19F-containing contrast agents, and hence will outperform existing MRI technology. Furthermore, target specific drug-loaded nanocontainers will offer high potential for β-cell directed therapies. VIBRANT will offer theranostic solutions to the utmost urgent problems in the health care management of diabetes, substantially improving the early diagnosis, thus preventing distressful and costly complications, contributing to the development of new therapies for the regeneration of β-cell mass, and thus directly impacting health status and life quality of patients, health care budgets and economies within the EU.

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**NBR: 228943** **ACRONYM: MULTIPLAT** **EC FUND: 2598329**

**DG:** RTD **Call: FP7-NMP-2008-SMALL-2** **Thema:** NMP-2008-1.1-1

**Title:** Biomimetic Ultrathin Structures as a Multipurpose Platform for Nanotechnology-Based Products

**Abstract:** The goal of the MultiPlat project is to develop biomimetic proton conductive membranes with nanometer thickness (nanomembranes) through convergence of a number of fields. The primary application of this multipurpose nanotechnological platform is the next generation of fuel cells where it will replace the prevailing evolutionary modifications of the state of the art solutions. Secondary applications cover diverse fields, including photonics, sensorics, biointerfaces, medicine and others. The natural proton conductive nanomembranes are the most ubiquitous building element in biology. The core concept of the project is to postulate, introduce and fabricate a novel composite nanomembrane and to functionalize them through the integration of proton conducting nanochannels in a manner analogous to that in biological cells. At the same time the nanomembranes will be strengthened through the introduction of inorganic part. This functionalisation itself is a complex and largely unsolved issue. In this way the nanomembranes will merge artificial and biological properties. We intend to use convergence of diverse fields including physics, chemistry, biomimetics, and nanotechnology. The focus will be primarily on the use of various nanotechnology methods for nanomembrane fabrication, their functionalisation through lamination, surface patterning, inclusion of fillers and structural modification through the engineering of built-in nanochannels. The research should result in functional models and a breadboard model. The industrial partners will ensure the application of the results. The objectives of the project fully satisfy the call NMP-2008-1.1-1 Converging sciences and technologies (nano, bio, info, cogni). The expected impacts include breakthroughs in knowledge in the converging fields, important practical applications and industrial innovations, with major significance for clean energy production, environmental protection and welfare improvement.

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**NBR: 228971** **ACRONYM: MONAD** **EC FUND: 2646773**

**DG:** RTD **Call: FP7-NMP-2008-SMALL-2** **Thema:** NMP-2008-1.1-1

**Title:** Molecular Motors-based Nanodevices

**Abstract:** The MONAD project will focus on the design, fabrication and implementation of dynamic nanodevices based on the purposeful interaction of nano-structured surfaces

and nano-objects with protein linear molecular motors - ubiquitous biological nano-machines responsible for biological functions as diverse as cell movement and division, transport of vesicles and muscle contraction. The project will develop novel hybrid nano-bio-devices which will allow (i) quasi-immediate diagnostics, compared with the present hours-long response time; (ii) entirely new, efficient high throughput drug discovery for critical diseases, e.g., cancer; and (iii) new methodologies to study the information storage and processing processes in individual cells, with wider impact on medicine and health care industry. This high level of inter-disciplinary innovation will lead to further future new industrial applications, such as immediate, personalised diagnostics. The research consortium will undertake the whole innovation path on molecular-motors based devices, starting from fundamental science to the implementation of the research in demonstration devices for health care and industry. We can pursue this comprehensive science, technology and engineering knowledge transfer because of the existing synergism within the consortium between academia, research institutes and industry. In the context of NMP-2008-1.1-1 the MONAD project will advance the development of protein molecular motors-based devices, well beyond the state of the art, leveraging on, consolidating, and making sustainable the already commanding position of European research in this very specific, paradigmatic-shift emerging area. On a more general level, MONAD will advance and consolidate the high added value of European biomedical industry in the global world market, as well as providing a new high-added value economic rationale to the excellent European semiconductor device knowledge and capability.

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**NBR: 228980** **ACRONYM: CAMINEMS** **EC FUND: 3551143**

**DG:** RTD **Call: FP7-NMP-2008-SMALL-2** **Thema:** NMP-2008-1.1-1

**Title:** Integrated Micro-Nano-Opto Fluidic systems for high-content diagnosis and studies of rare cancer cells

**Abstract:** The project aims at developing a new integrated and automated microfluidic tool for cancer cells screening. This instrument will have a reliability and power much beyond state of the art (capture yield increased by a factor from 10X to 100X and multimodal typing of the cells in 3D high resolution images), allowing earlier and more accurate diagnosis, prognosis and selection of treatments of cancers. CaMiNEMS's new approach will involve a new generation of bio-functionalised multifunctional magnetic nano and microparticles which will be self-assembled by a Hierarchial Templated Self-Assembly mechanism into high-aspect ratio reversible arrays. For highly automated molecular typing of cancers, this key innovation will be integrated with a unique fully automated flow control system working from nanolitres to millilitres and with innovative nano-optics tools and image analysis software. Technological developments will be validated regarding the analysis of circulating tumour cells or "micrometastases" and the molecular typing of minimally invasive microsamples from tumours. The project will also

yield new tools for research and drug-discovery, allowing for the first time to study at the single molecule scale in single cancer cells from patients the fate and action of new generation anticancer drugs using innovative dynamic tracking of Quantum dots. To combine research excellence and societal impact, the consortium involves research groups with complementary competences in microfluidics, nano-optics, biophysics, nanoparticles, biochemistry, informatics, several forefront cancer centres for clinical validation and a research-intensive SME for exploitation.

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**NBR: 228999** **ACRONYM: SMASH** **EC FUND: 8299360**

**DG:** RTD **Call: FP7-NMP-2008-LARGE-2** **Thema:** NMP-2008-2.2-1

**Title:** Smart Nanostructured Semiconductors for Energy-Saving Light Solutions

**Abstract:** Solid state light sources based on compound semiconductors are opening a new era in general lighting and will contribute significantly to a sustainable energy saving. For a successful and broad penetration of LEDs into the general lighting market two key factors are required: high efficiency and low cost. Two new disruptive technologies based on nanostructured semiconductors are proposed to address these key factors. A novel epitaxial growth technique based on nanorod coalescence will be explored to realize ultra-low defect density templates which will enable strain-relieved growth of LEDs and thus achieve higher efficiency. The second highly innovative approach is the growth of directly emitting Gallium nitride based nanorod structures. These structures are expected to produce exceptionally high efficiency devices covering the whole visible spectrum and even phosphor-free white LEDs. Significantly, our new nanostructured compound semiconductor based technology will enable LED growth on low-cost and large-area substrates (e.g., Silicon) as wafer bowing will be eliminated and thus lead to a dramatic reduction in production costs. The main objectives over the three years are:
•Profound understanding of the growth mechanisms and properties of nanorod systems
•New materials and process technologies (wafer-scale nanoimprinting, dry etching, device processing) for LEDs based on nanostructured templates and nanorod-LEDs
•Demonstrators: -Phosphor-converted white LEDs based on nanostructured sapphire templates (efficacy ≥ 150 lm/W @ 350 mA) and Silicon templates (efficacy ≥ 100 lm/W @ 350 mA) -Blue, green, yellow and red emitting Nano-LEDs (external quantum efficiency ≥ 10%) -Novel phosphor-free white-emitting Nano-LEDs (external quantum efficiency ≥ 2%) Realising the objectives of SMASH will start a new generation of affordable, energy-efficient solid state light sources for the general lighting market and will push the LED lamp and luminaire business in Europe.

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**NBR: 229034** **ACRONYM: SIMBA** **EC FUND: 2869275**

**DG:** RTD **Call: FP7-NMP-2008-SMALL-2** **Thema:** NMP-2008-2.1-2

**Title:** Scaling-up of ICP technology for continuous production of Metallic nanopowders for Battery Applications

**Abstract:** Although the development of nanoparticles-based materials has advanced rapidly in recent years, industrial production techniques have not kept pace. At this point there is a substantial need for safe production facilities, enabling the synthesis of large amounts of metallic nanoparticles with controlled and uniform quality (particle size, particle size distribution, chemical composition, etc.). This project will respond to this need by developing an industrial production line including on-line monitoring systems, assuring at the same time safety for the operating personnel as well as for the surrounding environment. The nano-structured materials of interest for this project are silicon and silicon-based alloyed nanoparticles, which have a huge potential as anode material in battery applications. With the aim to realise long life, high capacity Li-ion batteries, a new anode material with a volumetric capacity three times higher than the standard graphite anode has to be developed. The potential to replace 50% of turnover of the battery graphite market will generate a business of min 200 Mio € per year. The overall objective of this project is to transfer the ICP processing knowledge and technology investigated at a lab-scale to an industrial scale apparatus for the continuous production of tailored oxygen-free Si-based nanopowders at a production rate between 1and 10 kg/hour.

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**NBR: 229036** **ACRONYM: ORION** **EC FUND: 6896960**

**DG:** RTD **Call: FP7-NMP-2008-LARGE-2** **Thema:** NMP-2008-2.4-1

**Title:** ORDERED INORGANIC-ORGANIC HYBRIDS USING IONIC LIQUIDS FOR EMERGING APPLICATIONS

**Abstract:** ORION puts together a multidisciplinary consortium of leading European universities, research institutes and industries with the overall goal of advancing the fabrication of inorganic-organic hybrid materials using ionic liquids. Maximum research efforts within ORION will be addressed to achieve inorganic-organic hybrids with an ordered nanostructure and to understand and characterize the new generation of inorganic-organic hybrids. ORION aims to take advantage of the properties of Ionic Liquids as templating supramolecular solvents in the synthesis of novel hybrid materials. Additionally, the use of ILs will bring innovative properties to the hybrid materials due to their intrinsic wide electrochemical window and high ionic conductivity and hence this method will generate radically new materials. The new ordered inorganic-organic hybrids will be morphologically and electrochemically characterized with emphasis on their potential application in batteries, innovative solar cells and gas sensors. By

reaching this ambitious goal, ORION will pave the way towards inorganic-organic hybrid products for chemical, materials, energy and sensor industries.

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**NBR: 229063** **ACRONYM: COMETNANO** **EC FUND: 1748404**

**DG:** RTD **Call: FP7-NMP-2008-SMALL-2** **Thema:** NMP-2008-1.2-3

**Title:** Technologies for Synthesis, Recycling and Combustion of Metallic Nanoclusters as Future Transportation Fuels

**Abstract:** COMETNANO project is an integrated approach of metallic-nanoparticles synthesis, their controlled combustion in internal combustion engines and regeneration of the respective metal-oxides via reduction by renewable means. The main objectives of COMETNANO project are the following: -The production of tailor-made metal fuel nanoparticles with controllable combustion rate. -The utilization of an environmental-friendly way for the regeneration of burned particles (oxides), employing 100% renewable hydrogen produced by solar-thermal dissociation of water in coated monolithic reactors. Under such a concept, metal particles become an energy carrier and a means of converting hydrogen-energy into a medium that can be stored and transported easier and safer. -The innovative exploitation of low-cost raw materials, such as discarded fractions/wastes or by-products of metal industries, for the production of the initial metallic nanoparticles. -The introduction of required modifications, based on the existing mature technology of conventional internal combustion engines (ICEs), for the definition of the first metal-fuelled ICE. -The elimination of NOx emissions by proper combustion tuning. -The investigation of potential environmental and health dangers stemming from metallic and oxidic nanoparticles and the introduction of basic protection measurements. The successful completion of COMETNANO project will provide the necessary answers concerning the feasibility and the environmental benefits of such an innovative concept, thus stimulating the interest of both automotive and metal industries. The COMETNANO consortium consists of 5 organizations from 4 E.U. countries, including 2 Industrial partners, 2 Research Institutes and 1 University.

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**NBR: 229100** **ACRONYM: NANOCLEAN** **EC FUND: 2906692**

**DG:** RTD **Call: FP7-NMP-2008-SMALL-2** **Thema:** NMP-2008-2.1-2

**Title:** Optimisation and upscaling of self-cleaning surfaces for automotive sector by combining tailored nanostructured machined injection tools and functional thermoplastic nanocompounds

**Abstract:** Progress in nanotechnology benefits achieving new functions and features for numerous new products and applications through the knowledge-based tailored properties. However, despite these special features, there are many challenges to transfer real applications into our daily life. NANOCLEAN project seeks to demonstrate the up-scaling of tailor-made nanostructured based self-cleaning feature on plastic components through cross disciplinary approach. In particular, the proposed technology is based on stable and durable so-called lotus-effect from both chemical and physical methods such as nano/micromachining - templation technologies and nanomodified materials. Therefore, the project will evaluate and assess the large scale production of advanced nanostructured plastic components for automotive sector, with controlled wettability properties, by combining the application of specific nano-microstructured surface through enhanced energy femtosecond laser pulse, specialty formulated and modified polymers and industrially implanted injection moulding technology. Furthermore, due to versatility of proposed process, an effort will additionally be carry out to promote this technology of controlling the wetting properties of large volume market plastic products for application to very many different systems where liquid and solid phase are in contact (consumer products, medical products, microfluidic, electric/electronic appliances……).

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**NBR: 229108** **ACRONYM: MINTWELD** **EC FUND: 3550000**

**DG:** RTD **Call: FP7-NMP-2008-SMALL-2** **Thema:** NMP-2008-2.5-2

**Title:** Modelling of Interface Evolution in Advanced Welding

**Abstract:** Welding is the most economical and effective way to join metals permanently, and it is a vital component of our manufacturing economy. In welding, work-pieces are mixed with filler materials and molten, to form a pool of metal that upon solidification becomes a strong, permanent joint. Our ability to weld a metal to itself and to other materials is determined by the chemistry at the interface and by the complex morphology of the individual crystals at the weld centre. These boundaries are the critical regions where most catastrophic failures occur. Our project will establish the capability to design and engineer welding processes with a multi-scale, multi-physics computational modelling approach. An integrated suite of modeling software will be developed and validated, able to describe the key phenomena of the welding process at all relevant length scales, with a special emphasis on the solid-liquid interface evolution, including the description of macro-scale mass flow and thermal profiles, meso-scale solid/liquid interface movements, micro/nano-scale grain boundary and morphology evolution, mechanical integrity, and service life of the welded product. A unique aim of this project will be the prediction of interface evolution in industrially relevant systems, such as steel/steel and steel/Ni-based alloys. Validation will be ensured by state-of-the-art experimental techniques, including real-time synchrotron X-ray imaging, to observe morphological evolution of the interfaces, and electron microscopy and atom probe measurements to

characterise chemistry in grain boundaries. This project will deliver an accurate, predictive, and cost-effective tool that will find widespread application in the relevant European industry for penetrating novel markets of high economic and strategic importance enabled by a new capability for intelligent design of high performance welded systems and interfaces, an essential task to ensure that Europe maintains its competitiveness.

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**NBR: 229220** **ACRONYM: POLYFIRE** **EC FUND: 2254281**

**DG:** RTD **Call: FP7-NMP-2008-SMALL-2** **Thema:** NMP-2008-2.1-2

**Title:** Processing and Upscaling of Fire-Resistant Nano-Filled Thermosetting Polyester Resin

**Abstract:** Polyfire will develop and upscale techniques for processing halogen-free, fire-retardant nanocomposites and coatings based on unsaturated polyester resins and nanoclays. These materials will improve public safety and environmental impact by eliminating halogenated fire-retardants, which produce toxic combustion products. The ability of well-dispersed nanoparticles to enhance the fire-retardancy of thermoplastic polymers is well-established, but thermoset polyester has received relatively little attention. In a recent collaborative project, the fire-retardancy of polyester resin was dramatically improved on a lab scale by adding small amounts of organomodified nanoclay, along with significantly reduced amounts of other, non-halogen fire-retardant additives. However, significant further work is required to scale-up production and to assess the health and environmental impacts. This project will develop and upscale the nanoclay modification and will use novel mixing techniques to enable industrial-scale production of the nano-filled polyester. The project will generate turn-key solutions for easy integration into industrial SMEs. Nanocomposites and coatings will be produced and subjected to stringent tests. The technology will be demonstrated by producing 3 large-scale case study parts from construction, rail and marine sectors. Comprehensive health and environmental impact assessments will be conducted.

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**NBR: 229239** **ACRONYM: RECATABI** **EC FUND: 2328302**

**DG:** RTD **Call: FP7-NMP-2008-SMALL-2** **Thema:** NMP-2008-2.3-1

**Title:** Regeneration of Cardiac Tissue Assisted by Bioactive Implants

**Abstract:** Heart failure is the end-stage of many cardiovascular diseases, but the leading cause is the presence of a large scar due acute to myocardial infarction. Current therapeutic treatments under development consist in cellular cardiomyoplasty where myocardial cells or stem cells are implanted alone or encapsulated in natural scaffolds (collagens)

and grafted onto infarcted ventricles with the hope that cells will contribute to the generation of new myocardial tissue. This approach seems to have a beneficial effect although it is not completely understood and optimized, yet. Thus, the urgent need of better therapeutic platforms is imminent. In view of this, we created a small interdisciplinary consortium (RECATABI) with experts in areas such as material sciences, tissue engineering, stem cell technologies and clinical cardiovascular research. RECATABI will integrate and synergise their capacities in order to obtain a novel clinical platform to regenerate necrotic ischemic tissues after cardiac infarct with a simple one-time patch technology application. The consortium will accomplish this by fabricating nanoscale engineered biomaterials and scaffolds that will match the exact biomechanical and biophysical requirements of the implanted tissue. In addition, the construct may induce rapid vascularization to ensure tissue remodelling and regeneration into a newly functional myocardium. The regenerative capacity of the implants loaded with pre-adapted cells (biomechanically and biophysically trained) will be assessed in small (rodents) and large (sheep) animal models.

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**NBR: 229244** **ACRONYM: ENNSATOX** **EC FUND: 2816500**

**DG:** RTD **Call: FP7-NMP-2008-SMALL-2** **Thema:** NMP-2008-1.3-2

**Title:** Engineered Nanoparticle Impact on Aquatic Environments: Structure, Activity and Toxicology

**Abstract:** The use of engineered nanoparticles in cosmetics, pharmaceuticals, sensors and many other commercial applications has been growing exponentially over the past decade. EU and Member State's research into the environmental impact of these materials, particularly in aquatic systems, is at an early stage. ENNSATOX addresses this deficit through a, comprehensive investigation relating the structure and functionality of well characterised engineered nanoparticles to their biological activity in environmental aquatic systems. An integrated approach will assess the activity of the particles in a series of biological models of increasing complexity. Parallel environmental studies will take place on the behaviour of the nanoparticles in natural waters and how they modify the particles' chemical reactivity, physical form and biological activity. An integrated theoretical model will be developed describing the environmental system as a series of biological compartments where particles transport between a) compartments by advection-diffusion and b) between phases by a transfer function. Following optimisation of the transfer functions a generic predictive model will be derived for the environmental impact of each class of nanoparticle in aqueous systems. A generalised understanding of the dependence of the nanoparticle biological activity on its structure and functionality will be obtained including the role and interaction of the biological membranes within organisms. ENNSATOX will generate: 1) exploitable IP (devices and ecotoxicology predictive software package); 2) set of standard protocols for assay of nanoparticle biological activity which can be later accredited; 3) global dissemination of

results; 4) creation of an EU laboratory service; 5) tools and data to inform EU Regulation and the EC's code of conduct for responsible nanosciences and nanotechnologies research, ftp://ftp.cordis.europa.eu/pub/nanotechnology/docs/nanocode-recommendation-pe0894c08424_en.pdf.

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**NBR: 229255** **ACRONYM: 3D-NANOBIODEVICE** **EC FUND: 3548000**

**DG:** RTD **Call: FP7-NMP-2008-SMALL-2** **Thema:** NMP-2008-1.1-1

**Title:** Three-dimensional nanobiostructure-based self-contained devices for biomedical application

**Abstract:** The main scientific objective of the project is to enhance the understanding of the fundamental principles for controlling electron transfer reactions between nanoparticles (NPs), carbon nanotubes (CNTs), their assemblies confined into three-dimensional (3D) microscale networks, conductive nano/-microporous silicone (NMPSi) chips and different bioelements, such as glucose oxidising and oxygen reducing enzymes. The technological objective of the project is to construct potentially implantable microscale self-contained wireless biodevices working in different biomatrices, e.g. blood, plasma, saliva. Novel biodevices will be constructed by combination of glucose and oxygen sensitive biosensors powered by biofuel cells, all made from 3D nanobiostructured materials and operated by wireless microtransmitter/transducer system. To produce 3D microscale devices with superior characteristics mathematical modelling of their performance will be compared against experimentally determined parameters. Nanowiring of appropriate redox enzymes with NPs, CNTs, proper surface modifications, and use of Os and Ru redox complexes, are chosen as a major direction to solve main obstacles in the area of bioelectronics, i.e. poor electronic communication between the biocomponents and the electronic elements along with insufficient operational stability. The 3D structure of nanobiodevices will provide very high efficiency and stability along with their miniaturisation for successful application in biomedicine and health care. The developed, wireless self-contained and potentially implantable, 3D nanobiostructure-based devices will be used to improve quality of life and increase safety in case of widely occurring chronic diseases. Moreover, in the long-term, 3D nanobiostructure-based elements will be essential for constructing devices to be used for neuron/nerve stimulations and compensation of human disabilities.

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**NBR: 229261** **ACRONYM: SSHOES** **EC FUND: 3509000**

**DG:** RTD **Call: FP7-NMP-2008-SME-2** **Thema:** NMP-2008-4.0-7

**Title:** SPECIAL SHOES MOVEMENT

**Abstract:** This project addresses the development and demonstration of new sustainable production capabilities for diabetic feet and fashion high added value consumer-centred product concepts, such as footwear and insoles and the conception and definition of industrial paradigms and infrastructures which relate to the footwear industry, characterised by large numbers of traditional SMEs exposed to global competition. The aim is to capitalise on new competitive strategies based on demand product differentiation and personalisation to deliver high quality to individual consumers. Specific addressed RTD topics will include: -innovative 3D integrated digitalization and design tools and solutions dedicated to personalised biomechanical and biomedical as well as style and aesthetics aspects; -adaptive production processes and technologies guaranteeing functionality, quality, performance and health; -micro and nano devices providing the product with innovative sensing and actuating functionalities, such as comfort, ease of use, control and modification of product properties (thermal, pressure distribution); -innovative high-performing materials with self-adaptive capabilities to optimally fit consumers physique and ergonomics, whilst guaranteeing comfort and aesthetic quality; -materials and production processes to achieve full ecosustainability of the product; -development of specific methodology for functional assessment of products considering environment of use and individual consumers; -dynamic human behaviour modelling, in particular lower limb (feet).

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**NBR: 229275** **ACRONYM: I-PROTECT** **EC FUND: 2726399**

**DG:** RTD **Call: FP7-NMP-2008-SME-2** **Thema:** NMP-2008-4.0-9

**Title:** Intelligent PPE system for personnel in high risk and complex environments

**Abstract:** The main objective of the 4-year project is to develop intelligent personal protective equipment (PPE) system that will ensure active protection and information support for personnel in high risk and complex environments, in particular chemical rescue teams, firefighters and mine rescuers, who are exposed to fire, explosions, high temperature, dangerous substances, limited visibility, high humidity and limitation of breathable air. These high-level risks are reflected in a significant number of injuries and fatalities reported in the target sectors. The S&T objectives of the project are: - to integrate, within the new PPE system, state-of-the-art materials, active textiles, optical fibre sensors, gas and temperature detectors, ICT - to develop new materials (based on nanotechnology) and integrate them into PPE elements in order to enhance multi-functionality and adaptability; - to assure ergonomic design of new PPE and validate its functionality, safety, comfort and performance level by usability tests in real working conditions. The project is divided into 4 phases: 1) Conceptualization; 2) Technical development and integration, 3) Verification and validation; and 4) Dissemination and exploitation. The consortium consists of 16 partners from 6 countries: 5 RTDs, 8 SMEs, 2

industrial companies and 1 non-profit organisation. Three partners representing target groups participate in the whole project to guarantee full adaptation of the PPE system to users' needs. The project will have an impact on: the reduction of occupational injuries and disease in the EU (the population of end-users estimated at 3-5 mln.); European regulations (PPE Directive) and harmonised EN standards; European leadership in PPE-related research and innovation; the growth of European PPE market and the development of ERA in the area of industrial safety.

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**NBR: 229284** **ACRONYM: ADDNANO** **EC FUND: 8502703**

**DG:** RTD **Call: FP7-NMP-2008-LARGE-2** **Thema:** NMP-2008-1.2-1

**Title:** The development and scale-up of innovative nanotechnology-based processes into the value chain of the lubricants market

**Abstract:** The objective of the AddNano project is to investigate the prospects for overcoming the many existing technological barriers in the supply and usage chain, towards the establishment of a large scale market introduction of a new generation of fluid lubricants incorporating nanomaterials. The AddNano consortium combines technological expertise and industrial representation from all parts of the prospective value chain to investigate the development of new nano-based lubricants. Fluid lubricants are used in almost every field of human technological activity and their purpose is multifold: they reduce frictional resistance, protect the engine against wear between contacting surfaces, remove wear debris, reduce heating and contribute to cooling, improve fuel economy, improve emissions. Advanced nanomaterials recently developed, such as inorganic fullerene-like materials (IF's) and others, have shown some initial promise for their contribution to reducing friction and enhancing protection against wear. If able to be developed into full commercial-scale production, if they can be incorporated in a stable fashion into full formulations, and if their performance benefits relative to the best of conventional technologies can be sustained under those circumstances, they offer the prospect for some performance breakthroughs not seen since the development of the now ubiquitous anti-wear additives, Zinc Dialkyl Dithiophosphates (ZDDP's), around 70 years ago. Within engine oils and other lubricant applications, such as transmission fluids, and for greases used in rotational bearings, the potential exists for lubricants containing nanomaterials to significantly reduce friction and enhance machine durability. This can contribute to substantial energy savings, reduced equipment maintenance and longer machine lifetime.

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**NBR: 229289** **ACRONYM: NANOII** **EC FUND: 5310000**

**DG:** RTD **Call: FP7-NMP-2008-LARGE-2** **Thema:** NMP-2008-4.0-1

**Title:** Nanoscopically-guided induction and expansion of regulatory hematopoietic cells to treat autoimmune and inflammatory processes

**Abstract:** We propose a multidisciplinary program, focusing on the development of novel approaches for directing the differentiation, proliferation and tissue-tropism of specific hematopoietic lineages, using micro- and nano-fabricated cell chips. We will use advanced nanofabricated surfaces functionalized with specific biomolecules, and microfluidics cell chips to specify and expend regulatory immune cells for treating diverse inflammatory and autoimmune disorders in an organ- and antigen-specific manner. The proposed cell-chip will create ex-vivo microenvironments mimicking in-vivo cell-cell interactions and molecular signals involved in differentiation and proliferation of hematopoietic cells. Cell chip development and optimization will be supported by high throughput microscopy to select for optimal conditions. “Educated” cells will be employed for in vivo experiments in mice and the methodology will be further adapted for human cell populations, and applied for clinical diagnosis and therapy as well as the developments of clinically-relevant devices. Regulatory T-cells are extremely promising cells for treatment of inflammatory and auto-immune disease, as well as for tolerance induction in organ transplantation. To be effective they must be produced conveniently, at large numbers with an optimally tuned phenotype. The methodology is suggested to overcome current obstacles in obtaining therapeutically significant numbers of T cells. We propose to apply the suggested methodology for treating different inflammatory or autoimmune diseases including type-1 diabetes using targeted immunotherapeutic approaches. Developing new methods for producing large numbers of finely-tuned and tissue-targeted regulatory cells will make this approach clinically viable. This novel methodology can be extended to directing differentiation of other specific T-cell and hematopoietic lineages, with possible applications for targeting other autoimmune diseases and treating tumors or graft rejection.

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**NBR: 229292** **ACRONYM: FIND AND BIND** **EC FUND: 3594828**

**DG:** RTD **Call: FP7-NMP-2008-SMALL-2** **Thema:** NMP-2008-1.1-1

**Title:** Find and Bind: Mastering sweet cell-instructive biosystems by copycat nano-interaction of cells with natural surfaces for biotechnological applications

**Abstract:** Living cells are complex entities with remarkable capacity to sense, integrate and respond to environmental cues. The term directional sensing refers to the ability of a cell to determine the direction and proximity of an extracellular stimulus and to convert this information into biochemical signals. So far, the mechanisms of this extremely complex process are to be elucidated. Undoubtedly, carbohydrates are a class of molecules which together with the proteins span a large spectrum of these mechanisms: from those that

are trivial to those that are crucial for the development, growth, function or survival of an organism. Find and Bind aims to explore the potential of this class of molecules to mediate specific recognition events and therefore to provide modulation of biological processes. Approaching and employing the nanoscale mechanisms of the interactions of cells and their physiological milieu Find and Bind will create biological design criteria for the development of new materials and devices constructed from these materials. Taking the cell-matrix adhesion to the third dimension by re-creating both signals and timing of natural occurring events will be applied to develop third generation polysaccharide based constructs. Combining nanostructured scaffolds from naturally derived polymers and the incorporation of biological signals will provide inherent informational guidance in recreating cell-cell interactions and control tissue formation in vitro and in vivo. The long-term innovation potential of the developed constructs as (i) 3D cell instructive materials able to restore and enhance the functions of healthy tissues; (ii) Biosensors and (iii) Surfaces for selective differentiation of stem cells will also be in the targets of this proposal.

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**NBR: 229294** **ACRONYM: NANOCARD** **EC FUND: 3806600**

**DG:** RTD **Call: FP7-NMP-2008-SMALL-2** **Thema:** NMP-2008-2.3-1

**Title:** Nanopatterned scaffolds for active myocardial implants

**Abstract:** Cell therapy and tissue engineering are emerging as novel therapeutic paradigms for myocardial repair. The rationale behind the cell replacement approach is based on the assumption that an increase in the number of functional cardiomyocytes within the diseased area may improve the mechanical properties of this compromised region. A common strategy attempts to initially combine, ex-vivo, cells with polymeric scaffolds to generate a construct, followed by in-vivo engraftment onto the heart muscle. Despite first encouraging results, the clinical utility of these approaches is hampered by the paucity of cell sources for human cardiomyocytes and by the limited direct functional integration of grafted cells and high degree of donor cell death following cell grafting in host myocardial tissue. NanoCARD will create a conceptually new type of biomimetic nanoscopically designed scaffold able to generate cardiac tissue replacement for the myocardium. Within our project we will design novel cellular environments with broad but precisely-controlled diversity in chemical composition, physical properties, and geometrical spacing of individual peptides on the nanometre scale. The capability of these environments to regulate cell response will be explored by high throughput approaches using a new chip technology developed within the project. An additional unique concept for controlling the function of cardiac cells is given by applying periodic mechanical strain in the range of heart frequency during the tissue engineering process. The knowledge gained within NanoCARD will be translated into the design and production of a novel biocompatible nanostructured device (therapeutic surface) with a desired bioactivity inducing specific behaviour of endothelial cells and cardiomyocytes

to revolutionise treatment of myocardial defects. The inclusion of relevant companies in the consortium assures the identification of opportunities for the intended product developments.

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**NBR: 229335** **ACRONYM: MAGPRO²LIFE** **EC FUND: 7399827**

**DG:** RTD **Call: FP7-NMP-2008-LARGE-2** **Thema:** NMP-2008-1.2-1

**Title:** Advanced Magnetic nanoparticles deliver smart Processes and Products for Life

**Abstract:** Biotechnologically derived substances for large scale feed, food and pharma applications represent one of the most important sources of new products due to their precisely controlled structural and functional properties, potential for economic and responsible production and overall broad benefits to society through biocompatibility and sustainability. The costs of producing biomaterials are in many cases dominated by separation processes, which can constitute 80% of the total cost of production. Using smart magnetic adsorbent particles to selectively separate the target product out of a complex product mixture like the fermentation broth or bio-feed stock can drastically reduce costs. By using magnetic separation and extraction technologies to separate the magnetic carrier particles, novel processing ways emerge. The main objective of the MagPro²Life project is to scale-up innovative nanotechnology based processes defined in the previous NanoBioMag Project, funded by the EU under the FP6 programme (NMP3-CT-2005-013469), to pilot-line-scale and demonstrate those for bio, food and pharma applications. Link to market needs is represented by a preliminary product selection of natural soy based nutraceuticals or pharmaceuticals like Bowman-Birk Inhibitor (BBI), a proteases inhibitor for MS-treatment, and Lunasin which is in discussion to have anti-carcinogenic properties as well as recombinant proteins and nucleic acids (Fragment-Antibody-Binding and Phytase). The Consortium is driven by the potential the magnetic separation technology has for improving the value-chain in industrial production for emerging biotech, food and pharma markets.

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**NBR: 229336** **ACRONYM: FIT4U** **EC FUND: 3984125**

**DG:** RTD **Call: FP7-NMP-2008-SME-2** **Thema:** NMP-2008-4.0-7

**Title:** Framework of Integrated Technologies for User Centred Products

**Abstract:** Ongoing social and economic globalization processes will offer major challenges on the global market for consumer oriented manufacturing sectors. In particular, the shoes and gloves markets are expected to grow by more than 25% within the next 5 years, and the market niches for high value added shoes and gloves are expected to grow even faster.

As a consequence there is today a unique opportunity for the European Footwear and Sport Industries to improve their competitiveness on such market segments. To face such a challenge the present project will develop a new engineering framework for both products & processes integrating: new technologies and devices to integrate the consumer in shoes and gloves conception, specification and design; innovative 3D knowledge based integrated design tools; micro and nano devices providing shoes and gloves with innovative sensing and actuating functionalities; innovative high-performing materials with self-adaptive capabilities; adaptive production processes and technologies; new bio-materials and clean production processes. The expected outcome of the proposed project will be an integrated technology framework for the engineering of fully personalised shoes and gloves based on a 3 to 5 days time-to-market criterion. Such a framework will be validated and assessed on pilot production lines, and new differentiated consumer-centred shoes and gloves will be delivered as fully engineered prototypes. Main objectives of present project proposal are to raise competitiveness of the European Footwear and Sport Industry on the shoes and gloves high value added global market niches, so giving the opportunity to many European companies along the considered value chains to grow by more than 25% in the next 5 years; and to improve consumers satisfaction and well being through differentiated, comfortable, safe, healthy, affordable and sustainable user centred high value added shoes and gloves.

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**NBR: 229337** **ACRONYM: BACWIRE** **EC FUND: 2949999**

**DG:** RTD **Call: FP7-NMP-2008-SMALL-2** **Thema:** NMP-2008-1.1-1

**Title:** Bacterial Wiring for Energy Conversion and Remediation

**Abstract:** The aim of the project is to develop a new paradigm for the simultaneous cogeneration of energy and bioremediation using electro-active bacteria. A new nano-structured transducer that efficiently connects to these bacteria will be developed, aiming to the production of devices with superior performance across a range of applications including microbial fuel cells, whole cell biosensors and bioreactors. Elucidation of mechanisms by which bacteria transport electrons to solid electrodes is crucial. In this way, well-defined surfaces of single crystals and multilayered gold deposits on quartz elements will be used to resolve the interfacial electrochemistry of both, bacteria and isolated bacterial surface redox molecules. The spatial distribution of cytochromes in the cell surface will be determined by AFM and those involved in the electric connection to electrodes will be studied in detail. Nanoparticle-containing molecular bridges will be designed and constructed to connect electro-active bacteria to the electrode. Afterwards, tethered bacterial biofilms will be used in the development of technological application including reactors for the simultaneous cleaning of wastewater and the generation of clean energy.

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**NBR: 229375** **ACRONYM: SMD** **EC FUND: 3421500**

**DG:** RTD **Call: FP7-NMP-2008-SMALL-2** **Thema:** NMP-2008-1.1-1

**Title:** Single or few molecules detection by combined enhanced spectroscopies

**Abstract:** Future breakthroughs in the understanding of fundamental biological processes causing major diseases are expected from the development of miniaturized probes or microscopes able to detect and identify a single or a small number of molecules. The SingleMoleculeDetection (SMD) proposal will develop a unique device able to perform simultaneously and in a dynamic way force and spectroscopic measurements. We will design and fabricate novel devices for the generation of plasmon polaritons as well as combine photonic crystals and plasmonic nanolenses. These new devices will be able to detect few/single molecules through Raman, InfraRed and Terahertz (THz) signals and in combination with Atomic Force Microscopy and Optical Tweezer force spectroscopy with a spatial resolution in the sub-10 nm for Raman and IR and sub-100 nm for the THz region. The complete characterization of single unknown molecule will be demonstrated through: i- investigations on the chemical and physical properties of membrane receptors, such as rhodopsin, odorant receptors and ionic channels; ii- identification of new molecules involved in cancer development and metastasis. The new devices will allow the acquisition of THz images and we will explore the possibilities of this new spectral region for biomedical scanning. The SMD proposal is based on an original idea of the coordinator, prof. E. di Fabrizio and will be exploited thanks to the complementary expertise present in the different sites and to a tight coordination between the various groups. The design, fabrication and testing will be performed at UMG, TASC and CBM Integration in a single instrument will be carried out at TASC, CBM, IIT Nanotec, RUB. Validation activities will be performed by all the partners taking advantage of the world leading expertise of the TUDO and the STRATH- AC in spectroscopy of natural and artificial biological systems. The SME NANOTEC and CBM will provide the commercial exploitation of the obtained results.

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**NBR: 229507** **ACRONYM: NANOMAT** **EC FUND: 795550**

**DG:** RTD **Call: FP7-REGPOT-2008-1** **Thema:** REGPOT-2008-1-01

**Title:** Centre of Excellence for Nanostructured Materials

**Abstract:** The overall aim of the NANOMAT project is to build the research capacity in converging sciences and micro/nanosystems at the Research Centre for Microsystems and Nanotechnology, Kaunas University of Technology (RCMN-KTU), to the highest European level and create a European Centre of Excellence in Nanostructured Materials. RCMN-KTU is a very promising European research organisation as demonstrated by its

participation in five FP5 and FP6 networking projects in the fields of nanoscience and microsystems. The Centre of Excellence will be created through a range of capacity building activities derived from RCMN-KTU's SWOT analysis. The activities will increase RCMN-KTU's competitiveness and visibility in the most advanced topics of converging sciences and micro/nanosystems: 1. Nanostructures by ionic self-assembly of porphyrins; 2. Near field optical microscope for cells research; 3. Electro-mechanics of cells and biostructures; 4. Growth and formation of carbon nanotubes structures by chemical vapour deposition; 5. Development of gas sensors based on functionalized porphyrin nanotubes; and 6. Development of micromachined silicon cantilevers for scanning shear force microscopy applications. Central to the activities are twinning partnerships with 3 specialist research groups: Centre for Nanoscience and Quantum Information, University of Bristol; Micro and Nanosciences Laboratory, Helsinki University of Technology; and the National Centre for Microelectronics, Barcelona. RCMN-KTU will increase its human potential by hiring 3 young experienced Lithuanian researchers and organising training stages. RCMN-KTU will increase its technology potential by upgrading its existing scanning probe equipment by Nano-Raman,TERS, confocal microscopy and purchasing a controlled frequency synthesizer and ultra-high resolution frequency discriminator. Finally, the NANOMAT project addresses research priorities identified by the EU Technology Platforms MINAM and Nanomedicine as well as FP7 NMP and ICT Work Programmes.

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**NBR: 229514** **ACRONYM: KEEN-REGIONS** **EC FUND: 969999**

**DG:** RTD **Call: FP7-REGIONS-2008-1** **Thema:** REGIONS-2008-1-01

**Title:** Knowledge and Excellence in European Nanotechnology - Regions

**Abstract:** EU Commissioner Janez Potonik stated that "nanotechnology is an area which has highly promising prospects for turning fundamental research into successful innovations." The potential applications of nanotechnology are wide-ranging and rapidly increasing, demonstrating a field that has the potential to act as a powerful catalyst for economic development. To gain a competitive position in this exciting terrain and to foster industrial innovation, EU research infrastructures require more and more resources: multidisciplinary competencies, investments for up-to-date technical equipments, skilled HR, and strong links to the business community. To this end, many well-established research centres in Europe are working in research-driven clusters, aggregates of key-players who are not just researchers, but networks of competitive companies and public authorities. This is the case of Veneto Nanotech (Veneto), Minatec (Rhone-Alps) and Gaia (Basque Country) , which together control more than 200 M€ public investments, 2000 researchers, and 200 research laboratories. If these 3 clusters are to collaborate, combining and integrating their enormous wealth of resources to increase synergies and to complement one another, it will create a huge potential for research and economic development at the EU level. This is precisely the goal of KEEN (Knowledge and

Excellence in European Nanotechnology)-Regions. A three-step approach (mapping and analysis of existing resources, interactive exchanges and mutual learning, and a focused integration process) will lead to a Joint Action Plan, constructed by all interested stakeholders. Following a bottom-up philosophy and utilising the direct involvement of Regional Authorities, the JAP will ensure a quick and comprehensive implementation. KEEN also aims to eventually expand beyond these 3 clusters, exchanging methodologies and strategies with other EU clusters.

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**NBR: 229599** **ACRONYM: AMAROUT** **EC FUND: 3827061**

**DG:** REA **Call: FP7-PEOPLE-2007-2-3-COFUNDThema:** PEOPLE-2007-2-3.COFUND

**Title:** AMAROUT Europe

**Abstract:** AMAROUT Europe is a Project built by the IMDEA institutes with a clear double purpose, on one hand contributing to the development of the European researchers labor market and fostering and consolidating the European Research Area, and on the other turning Madrid into one of the top knowledge generation regions in Europe. The approach foreseen is directed to lead researcher's career through long learning training and career development under an individual driven perspective. The project will be driven by a consortium of eight IMDEA institutes (Institute for Advanced Studies) offering individual researchers the opportunity to propose research fellowships within some of the most promising research areas: water, food science, energy, mathematics, material science, nanotechnologies, networks and software. Within its four years funding period the project will offer to more than 120 fellows the opportunity to join one of these institutes (incoming, reintegration) and receive top level training and research opportunities. It is intended to provide the project with a much longer life. The selection process will strictly follow the European Code of conduct for the recruitment of researches and the Charter for researchers, and will be implemented through 8 international panels constituted by well-known scientist and ad-hoc selected specialists in the 8 research areas. The project will be supported by, main universities and research centers in the region, offering interaction and high renowned research teams, and by private companies from the Board of trustees In conclusion the AMAROUT Europe fellowship programme will play a key role in the strategic plans of IMDEA for the next ten years to foster the international mobility of 200 internationally recognized researchers and 400 young researchers. This initiative is regarded by the regional government as key programme towards turning Madrid into a world-class centre of scientce abd excellence in the knowledge society.

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**NBR: 229625** **ACRONYM: IMPROVING** **EC FUND: 87855**

**DG:** RTD **Call: FP7-REGPOT-2008-2** **Thema:** REGPOT-2008-2-01

**Title:** Improving the Research Capacity of the Institute of Materials Research in Kosice

**Abstract:** The objective of the present project aims to create the necessary tools for improvement the research capacity of the Institute of Materials Research of Slovak Academy of Sciences (IMR SAS) in Košice in the fields of nanomaterials and new technologies with the aim to increase it's contribution to regional economic and social development and for better participation in FP7 and other international projects. This will be realized through; • an international independent expert evaluation of the level of the overall research quality and management & research capability of the IMR SAS and; • definition and preparation of an Action Plan for improving their research and development capacities, based on the results of the evaluation and on discussion with representatives of the Centres in Europe, regional research and development authorities and utilizing the possibilities of cohesion policy programmes of EU for 2007-2013.

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**NBR: 229660** **ACRONYM: CERES** **EC FUND: 403200**

**DG:** REA **Call: FP7-PEOPLE-2007-2-3-COFUND** **Thema:** PEOPLE-2007-2-3.COFUND

**Title:** CEI Research Fellowship Programme

**Abstract:** The Central European Initiative intends to strengthen its CEI Research Fellowship Programme both in terms of quantity and quality, i.e. increasing the number of fellowship-years while improving the fellows' employment conditions. The CEI Research Fellowship Programme was established in 2005 under the aegis of the CEI Science & Technology Network, promoted by the CEI along with six Trieste-based centres of excellence with the purpose of enhancing scientific cooperation across its region. This proposal aims at reinforcing the CEI Research Fellowship Programme: it will cover a period of 44 months and envisage 30 incoming fellowships (12 months each) to be awarded to experienced researchers from CEI countries. Annual calls will be advertised through the CEI networks of experts and communication tools, disseminated on the occasion of CEI sponsored events and during both institutional and technical meetings. Researchers will be selected by an ad hoc Committee, whose composition will follow the "European Charter for Researchers and Code of Conduct for their Recruitment"; fellows will be given the opportunity to carry out research in one of the 5 partner institutions (International Centre for Theoretical Physics - ICTP; International Centre for Genetic Engineering and Biotechnology - ICGEB; Cluster in Biomedicine - CBM; International School for Advanced Studies – SISSA; Synchrotron – ELETTRA), which altogether cover a large spectrum of highly relevant scientific research such as physics, maths, genetics, biotechnology, neuroscience, nano-science, bioinformatics. This will allow a considerable freedom of choice as to research topics, in line with the bottom-up approach pursued by all "Marie Curie Actions". By exploiting synergies between the

Community action and the regional impact of its Research Fellowship Programme, the CEI will be able to strengthen trans-national mobility of researchers and to offer them excellent conditions for the development of their careers.

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**NBR: 229714** **ACRONYM: HEALTHGOVMATTERS** **EC FUND: 860478**

**DG:** RTD **Call: FP7-SCIENCE-IN-SOCIETY-2008-1** **Thema:** SiS-2008-1.2.1.3

**Title:** Health Matters: A Social Science and Ethnographic Study of Patient and Professional Involvement in the Governance of Converging Technologies in Medicine

**Abstract:** HealthGovMatters explores patients' and professionals' formal and informal involvement in governing the production and mediation of health and medical knowledge. We use rich social science and ethnographic methods, including interviews and participant observation, to address forms of engagement with predictive, diagnostic and therapeutic technologies. Our interest is in exploring interactions between constellations of actors (patients, care-givers, health professionals, citizens, and patient and professional organisations) who become involved in mediating and articulating the definitions and lived meanings of health, illness and disease in the context of encounters with new health technologies. We will focus on new imaging (predictive and diagnostic) technologies, computer implants and new pharmaceuticals/devices which are being developed and implemented in the fields of genetics and neurology - two key sites in which new technologies enabled by the synergism of developments in such core fields as nanotechnology, biotechnology, information technology and cognitive sciences are being integrated. Often referred to as "converging technologies", their integration in the area of medicine is viewed as holding the potential to vastly improve ICT capacity for medical data management and information generation and to provide the foundation for the translation of research knowledge into clinical trials and clinical practice. In the light of new developments, we are asking: How do patients and professionals at the experiential and institutional levels represent new diagnostic, predictive or therapeutic possibilities and make decisions regarding their development and use? Additionally, in what ways might the axes of gender and generation (and more specifically women and children) make a difference in how novel health technologies are conceptualised, developed, implemented or refused?

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**NBR: 230052** **ACRONYM: SYNBIOSIS** **EC FUND: 938955**

**DG:** RTD **Call: FP7-REGIONS-2008-1** **Thema:** REGIONS-2008-1-01

**Title:** Maximizing Synergies for Central European Biotech Research Infrastructures

**Abstract:** The main objective of SyBIOsys project is to pull together two research-driven clusters in the field covering the intersection of biotechnology/life science and ICT, more specifically, in the domains of bioinformatics, nanobio, computational biology and biomedicine. The two partner regions – South Moravia (CZ) and Friuli-Venezia-Giulia (IT) - share an interest in this particular research domain and also an interest in developing unique research infrastructures for this domain. While the Italian region has an existing unique research infrastructure in place (AREA Science Park with the Free Electron Laser, a part of ESFRI Road Map), South Moravia is in the process of designing its new research infrastructure and plans to fund it primarily from the EU Structural Funds. The focus of the project is thus on the valorisation of research infrastructure in these regions and strengthening collaboration with business sector. Emphasis is laid on collaboration, search for complementarities, synergies with activities of the Structural Funds, and on exploiting the experience of other EU regions in respect of opening up research infrastructures to collaboration with business sector. Mentoring will be used as an instrument that will especially contribute to a better design of the newly built infrastructure in South Moravia and, in case of both partner regions, to increase the economic relevance of research infrastructures and their tighter integration with the local economy. Simultaneously, emphasis will be laid on developing partnerships with other regions in the EU with a similar profile and interest with a special emphasis on the Central European region. The project aims, as a part of its activities, to enrol not only stakeholders in the two partner regions, but also to extend the network to the geographically proximate regions (Vienna/Austria, Bratislava/Slovakia, Ljubljana/Slovenia) with a view to share the experience and seek complementarities in research infrastructures.

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**NBR: 230193** **ACRONYM: INTERARCHIVE** **EC FUND: 2481920**

**DG:** ERCEA **Call: ERC-2008-AdG** **Thema:** ERC-AG-ID1

**Title:** Interred with their bones - linking soil micromorphology and chemistry to unlock the hidden archive of archaeological human burials

**Abstract:** It is apparent that soils/sediments immediately associated with buried archaeological human remains contain a valuable unexploited archive of archaeological information with physical and chemical signatures. Thus, excavation of human graves, for cultural reconstruction and to understand archaeological burial practices, aspects of human health and for forensic investigations would benefit significantly from development of a systematic and rigorous scientific approach, allowing maximum information retrieval. We propose a novel framework for sampling and analysis, applying complementary analytical approaches to ongoing burial excavations in 17 sites in Europe, North Africa and Mongolia. We aim to test the combined complementary power of soil micromorphology, inorganic geochemistry and organic chemical analyses to recover cultural and environmental information from historic and archaeological graves,

particularly in situations where physical remains can no longer be recognised visually. The analytical techniques will provide information at macro-, micro- and nano-scales, generating complementary data that will enable interpretation of physical remains according to chemical composition (organic and inorganic). The study will enable assessment of preservation potential as a function of soil type and chemistry and permit analysis of fluids movement through the burial environment and their impact on microscopic and chemical signatures. The new interdisciplinary approach that we will develop and validate will provide a protocol for the international archaeological and forensic communities, and sampling schemes for scientific analysis of archaeological/historical burials. The total combination of our results will produce an entirely new richer picture of unseen cultural and biological associations with burials. We expect to deliver a new framework for integrated sampling, analysis and interpretation of grave/burial soils with a comprehensive online searchable database.

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**NBR: 230291** **ACRONYM: EGAIS** **EC FUND: 837685**

**DG:** RTD **Call: FP7-SCIENCE-IN-SOCIETY-2008-1** **Thema:** SiS-2008-1.1.2.1

**Title:** The Ethical GovernAnce of emergIng technologieS â€“ New Governance Perspectives for Integrating Ethics into Technical Development Projects and Applications

**Abstract:** EGAIS will investigate the ethical governance in EU research projects with the goal of providing a framework for improved governance mechanisms that will address potential ethical issues arising from new and emerging technologies. The Ambient Intelligence projects will be used as a starting point of analysis, but the results will be tested to other emerging fields such as nanotechnologies, biodiversity and converging technologies. Usually projects with technical development do not sufficiently integrate the ethical issues that arise: the governance of ethics is missing and no guidelines have been provided at the EU and international level. These difficulties have been recognised at EU level, resulting in the attention paid to ethics and ICT in FP7 and partially in FP6. Adopting a bottom-up approach, EGAIS will investigate how ethical governance considerations could be embedded into the research and technology development culture of EU research so that they become a natural part of the evaluation and technical development process. The interdisciplinary project team will provide new governance guidelines addressing the integration of ethics into technical development projects that could be used in any field of technology development. Guidelines will emerge from the following steps: empirical analysis (of ethical governance measures within EU funded projects), classification of existing projects based on their ethical governance models and interpretation, application of theoretical outcomes to different technological domains to catalogue deficiencies in ethical governance mechanisms (portability of the problem), production of guidelines for concretely embedding ethics into projects in any EU technological development practices (portability of the solution). EGAIS will collect feedback from key stakeholders (EU policy makers, project leaders,

academia, etc.) through a series of workshops. Dissemination activities will include the industry and civil society.

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**NBR: 230330** **ACRONYM: SIAMPI** **EC FUND: 793302**

**DG:** RTD **Call: FP7-SCIENCE-IN-SOCIETY-2008-1** **Thema:** SiS-2008-4.0.2.3

**Title:** Social Impact Assessment Methods for research and funding instruments through the study of Productive Interactions between science and society

**Abstract:** Our project aims at developing a method for the assessment of the social impact of scientific research. We review current literature including experimental studies and conduct case studies in four different fields (nanotechnology, ICT, health, social sciences) with various grades of social impact, in both national and supranational settings. Our goal is both to enhance insight in social impact assessment and to develop assessment methods. We focus on social impact of research. However, since most studies of how research has an impact on society show the crucial role of productive interactions between science and society, our prime object of investigation is the identification of these interactions. Thus, social impact is not seen as the 'logical' consequence of a unilinear process, but as the outcome of an iterative practice in which researchers and stakeholders each play a role. By productive interactions we mean: Exchanges between researchers and societal actors in collaborative settings (networks) in which knowledge is produced and valued that is at the same time scientifically and socially robust and relevant. Therefore, we engage in our project not only researchers and policy makers, but also other relevant stakeholders in the various research areas. Analytically, we distinguish four main tracks through which such interactions may occur: (1) through direct personal contacts (ranging from mere meetings to complex arrangements for research collaboration), (2) mediated by specific outputs like expert reports, clinical guidelines, scientific advice, or through (3) the transfer of goods (products, social practices, therapies, policy tools), and (4) through funding or other support mechanisms, in short: people, texts, artefacts and support. Our objective is in the case studies to show how these interaction mechanisms form a necessary condition for research to have a social impact.

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**NBR: 230361** **ACRONYM: ETHENTECH** **EC FUND: 499889**

**DG:** RTD **Call: FP7-SCIENCE-IN-SOCIETY-2008-1** **Thema:** SiS-2008-1.1.2.1

**Title:** Ethics of enhancement technology

**Abstract:** The main objective of this ETHENTECH project is to take substantially further forward both the ethical evaluation and public discussion of two important emerging fields of micro- and nanobiotechnology which pose very significant ethical and societal issues of public concern: neurological implants and the potential for human functional enhancement. Neural implants are a major new class of medical devices, which create an interface between nerve tissues and nano- or micro-scale probes. The aim is to enable a patient's nervous system to communicate with new devices that replace or supplement a malfunctioning organ, for example to restore hearing or eyesight or to treat degenerative diseases like Parkinson's. Human functional enhancement technology refers to a wide range of converging technologies which have the potential to enable significant modification of the systems of the human body, beyond what might be seen as medical purposes. The subjects of the ETHENTECH project address some of the most far-reaching fields among new and emerging technologies today - in terms of their potential social impact and the challenges these will pose to ethical issues and values of European citizens and societies. The project's two fields of implant and human enhancement technologies both lack ethical frameworks and European and international guidelines. This absence reflects the emerging and complex nature of both areas. They also represent cases where issues of dual use are a significant and further complicating factor. While several EC and other projects have given useful overviews of the ethical terrain, it is clear that there is now a pressing need to engage in more depth with particular issues in order to focus ethical frameworks and guidelines around particular issues.

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**NBR: 230399** **ACRONYM: ULTRAFASTELECTRONS** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-IRG-2008** **Thema:** PEOPLE-2007-4-3.IRG

**Title:** Advanced ultrafast electron sources for quantum optics experiment with free electrons

**Abstract:** This proposal aims at the development of an electron source that will allow controlling the position of free electrons with extremely high precision in space and time. Such a tool will enable novel quantum optics experiments and might turn into an electron source widely used in time-resolved scanning electron microscopy and electron diffraction, a field in which Europe is currently trailing the US. The proposed experiment will be a complementary effort to the applicant's research that he is currently setting up with a Max Planck Junior Research Group Grant. After his PhD work in T.W. Hänsch's group the applicant spent four years as postdoctoral researcher at Stanford University and returned to Europe in November 2007. The proposed experiment will transfer much of the applicant's experience from the US and is based on the combination of a special field emission tip he developed in the US and a femtosecond laser oscillator. Femtosecond laser pulses hit the tip and so emit electrons from nanometric dimensions within timescales of a femtosecond. The final goal is a deterministic electron source, where one and only one electron is emitted with every laser pulse. Such a source would

immediately enable classic quantum optics experiments. Advanced emitters will be used that exhibit quantum behaviour such as single atom tips and carbon nanotubes where emission takes place from a single or few atoms only. The proposed work would ideally augment the experiments that the applicant will perform with the Max Planck funds and will initially go in parallel to these. Proposed experiments will potentially allow highly increased visibility of his research and will help him to take the next step towards a faculty position at a respected research institution in Europe. Furthermore, expected results will strengthen research in Europe in an underrepresented field, will be relevant to the applicant's former host at Stanford and will lead to continued collaboration on a peer level.

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**NBR: 230401** **ACRONYM: SYBHEL** **EC FUND: 803587**

**DG:** RTD **Call: FP7-SCIENCE-IN-SOCIETY-2008-1** **Thema:** SiS-2008-1.1.2.1

**Title:** Synthetic Biology for Human Health: Ethical and Legal Issues

**Abstract:** Synthetic Biology (SynBio) is a relatively new field of scientific endeavour. Rather than seeking to understand living organisms, SynBio researchers aim to design and build entirely new living systems at the molecular, cellular, tissue and organism level. SynBio uses methods and tools from many disciplines, notably engineering, genetics, biotechnology and biochemistry; but also nanotechnology, physics and computational modelling. A key attribute is the use of principles of engineering with components from the life sciences to build or exploit living organisms rather than machines. Applications of SynBio research include environmental and health benefits, for example bio-fuels, biosensors and therapeutics. Researchers in SynBio are keen to address the ethical, legal and social aspects of their work. To date, however, ELSI considerations of SynBio have targeted safety and regulatory aspects of the field as a whole. No studies have focussed specifically on the ethical implications of SynBio for human health. The SYBHEL project will address this gap to provide the first detailed analysis of one of the key global applications of SynBio. SYBHEL will examine several aspects of SynBio as it applies to human health including: philosophical and social understandings of life (including new human-like entities); appropriate methodology for bioethical analysis in SynBio for health; ethical issues arising in utilising SynBio for health; regulatory and commercial aspects and public policy in SynBio for health care. The RTD work-packages will be underscored by several cross-cutting themes to ensure maximum flexibility and relevance of outcomes. SYBHEL will therefore be informed by existing work on: the definition and scientific state of the art of SynBio; safety aspects and issues of distributive justice. SYBHEL will adopt an approach that recognises the non-reductionist, non-essentialist, dynamic and integrative nature of SynBio and will develop a comparable ethics response.

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**NBR: 230464** **ACRONYM: SYNTH-ETHICS** **EC FUND: 531276**

**DG:** RTD **Call: FP7-SCIENCE-IN-SOCIETY-2008-1** **Thema:** SiS-2008-1.1.2.1

**Title:** Ethical and regulatory challenges raised by synthetic biology

**Abstract:** SYNTH-ETHICS addresses the ethical, legal and social implications of the emerging field of synthetic biology, with a special focus on biosafety and biosecurity and on notions of life. The project starts with discerning relevant ethical issues in close collaboration with the synthetic biology community. Next, the public debates around these issues are analysed. The current ethical and regulative frameworks existing in synthetic biology and closely related fields like nanobiotechnology and genetic engineering will then be reconstructed and assessed for their ability to deal adequately with existing and newly emerging ethical issues in synthetic biology. On that basis, challenges for current regulatory and ethical frameworks will be identified and recommendations for dealing with these challenges will be formulated targeted at three relevant groups: 1) the synthetic biology community, 2) EU policy makers and 3) NGOs/the public The project is at the intersection of ethics, technology assessment and foresight, law, and new technologies, and expertise from all relevant fields is included in the project team. The project will build on insights and discussions from other fields such as biotechnology and nanotechnology. It will also try to assess which aspects of synthetic biology might give rise to ethical problems of a different nature, specific to the field. In turn, it will contribute significantly to a more adequate and proactive broadly applicable approach to the ethical aspects of new technology. It will contribute to a common understanding of synthetic biology and the ethical, legal and social issues involved in EU member states, and to the shaping of a distinct European approach without ignoring the discussions and developments in the US and elsewhere. Stakeholders' views will be solicited during the project and will be taken into account, and the project will help to prepare for a rational and informed public dialogue on synthetic biology. Finally, the project p

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**NBR: 230626** **ACRONYM: DEFFED** **EC FUND: 75000**

**DG:** REA **Call: FP7-PEOPLE-IRG-2008** **Thema:** PEOPLE-2007-4-3.IRG

**Title:** Design of froths and foams with entailed durability.

**Abstract:** This proposal aims at creating a methodology for the design of froths and foams of pre-conditioned durability. Such a methodology is greatly needed nowadays, because of the numerous applications of the froths and foams. The life-time of single foam films and the durability of froths/foams will be investigated under matching conditions. The effects of the bubble speed and bubble sizes on the durability of froths/foams will be

studied for a wide range of Gibbs elasticity values. Furthermore, the durability of foam films and froths/foams containing nano– and micro-hydrophilic and/or hydrophobic particles will be studied as well. The effect of the material of the foam column on the lifetime of froths and foams will be investigated additionally. In addition, a link will be established between the behaviour under identical conditions of the single foam films and the respective foam column. There is still a drastic lack of linkage in the literature between the results for foam films and foams, due to their isolated studying. Ultimately, the main factors affecting the durability of froths and foams will be brought together in a methodology for the design of foams of a wide scope of durability – from seconds to hours.

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**NBR: 230676** **ACRONYM: CARBOSORB** **EC FUND: 1284892**

**DG:** REA **Call: FP7-PEOPLE-IAPP-2008** **Thema:** FP7-PEOPLE-IAPP-2008

**Title:** CARBOSORB - Carbon (Nano) Sorbents for Environmental Remediation

**Abstract:** The aim of this project is to develop and manufacture permeable composite “filters” in which carbon-rich nanoparticles (or nanoporous materials) will be embedded (and contained in a recyclable 3D structure), and use these as the basis of recyclable, high performance water clean-up devices, for application in the environmental and industrial sectors. It brings together a multidisciplinary consortium of specialists in different areas of environmental (geo)chemistry, nanotechnology, and physical, analytical, synthetic, polymer and surface chemistry, working with a common aim of developing new and efficient methods of contaminant removal from surface and groundwaters, drinking waters, and trade and industrial effluents.

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**NBR: 230726** **ACRONYM: FIRE** **EC FUND: 1746690**

**DG:** REA **Call: FP7-PEOPLE-IAPP-2008** **Thema:** FP7-PEOPLE-IAPP-2008

**Title:** Fluid, Ions and Radiation Ensemble in Integrated Plasma Modelling

**Abstract:** Fast particles and nanoclusters are produced directly in energetic plasmas, with desirable results as in nanopowder production and undesirable results as in debris and fast particle damage in EUV light sources. The phenomena cover diverse disciplines, from plasma physics to atomic physics, from radiation transport to quantum mechanics, from magnetohydrodynamics to non-equilibrium chemistry. Modelling tools and techniques that can describe the complete process, from plasma formation to formation of energetic particles and large nanoclusters, are lacking. The FIRE project aims to bridge this gap through the collective experience and transfer of knowledge between 3

partners, all actively engaged in different aspects of the overall issue. The knowledge and techniques to be transferred between the research institutions and industrial partner will enhance the capability of modelling of discharge and laser produced plasma to study the plasma dynamics, spectral emission and the creation of nanoparticles for the semiconductor industry and in nanotechnology. A state of the art 2-D RMHD code Z* will be upgraded to include recent advances in atomic physics and evolved into a hybrid 3-D code to address key issues in industrial plasmas. In depth research experience in laser produced plasmas and discharge plasmas will be exchanged. Complex radiation understanding in unresolved transition arrays and non-stationary ionization in mutlicharge ions will be combined. Within the FIRE project, the innovative code created will be used to design the EUV sources together with debris mitigation systems for the lithographic industry on one side, and to optimize the plasma-gas interaction for a cost effective, scalable technology for size-controlled nanopowder production on the other. The theoretical work will be backed up by experimental measurements. The developed modelling tool is expected to be applied in other branches of science and technology.

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**NBR: 230766** **ACRONYM: NMS-CNT** **EC FUND: 633648**

**DG:** REA **Call: FP7-PEOPLE-IAPP-2008** **Thema:** FP7-PEOPLE-IAPP-2008

**Title:** Biocompatability of carbon nanoparticles with tissues of the neuromuscular system

**Abstract:** The partners wish to build a long-term European, industry-academia consortium, to work on the problem of repairing tissue damage in the neuromuscular system (NS). We initially seek to determine the biocompatibility of carbon nanoparticles with tissues of the NS as an essential prelude to our medium to long-term goal of developing marketable novel carbon nanotube-based implants for tissue repair of the NS. Presently, there is no satisfactory method for repairing extensive damage of the different tissues of the NS namely, nerves, muscles, ligaments and tendons. In the case of nerve lesions, the major problem associated with most of the recently developed implants is their limited capacity for organising regenerating axons appropriately for functional tissue re-innervation. We believe that CNTs due to their unique combination of physico-chemical properties could play a major role in overcoming these problems and therefore enhance tissue integration and nerve repair. In the case of damaged skeletal muscles and tendons, we envisage that CNTs could play a key role in strengthening and repair of these types of NS tissues.

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**NBR: 230777** **ACRONYM: ILP-ULTRA** **EC FUND: 43200**

**DG:** REA **Call: FP7-PEOPLE-IRSES-2008** **Thema:** FP7-PEOPLE-IRSES-2008

**Title:** Interaction of ultra-intense laser pulses with plasmas

**Abstract:** The goal of the present proposal is to coordinate the activities in the domain of laser-plasma interaction and high energy density matter between four partner laboratories and to elaborate more efficient relations between the theoretical developments,numerical simulations and experiments. The collaboration program accounts for the specific interests and the complementarily of competence of participating laboratories.The following subjects are chosen for the collaborative project.These are: 1.The electron and ion acceleration by the ponderomotive force of ultra-relativistic laser pulses in dense plasma and applications of this process to the fuel ignition in targets for the inertial confinement fusion. 2.Studies of effects of electron-ion collisions in a strong laser field and their effect on production of directed fluxes of high energy electrons and efficient plasma heating. 3.Interaction of intense laser pulses with low density structured targets (foams and aerogels) for the intense x-ray generation and laser beam smoothing. 4.Generation of intense electromagnetic pulses in the THz domain uisng the tightly focused sub-picosecond laser pulses. All subjects chosen in the project are at the front end of the contemporary research.They attract attention of leading scientific laboratories and make a part of many international high level projects.Among them there are European projects HiPER and ELI. The ponderomotive force of high intensity electromagnetic pulses was considered for many years as a promising way of acceleration of matter to high velocities.However,at non-relativistic intensities the laser energy absorption increases strongly the plasma temperature and the ablation pressure quickly dominates the radiation effects.The scientists of collaborating laboratories are participating in this work for several years and, independently each of them make some innovative proposals on how to improve the efficiency and performance of laser-particle acceleration in the relativistic regime.Such ideas that include multi-layered targets,foams,laser beam profiling and radiation cooling will be investigated jointly in the framework of the present project. The hard electron-ion collisions (at small impact parameters) that often neglected in plasma physics provide an efficient channel of electron acceleration in a strong laser field.This has been demonstrated in the recent publications of the scientists from IAP,LPI and CELIA.We are planning to extend these studies to the domain of relativistic laser intensities,to account for the quantum effects in the hard collisions and to evaluate the potential of collisions for the laser particle acceleration. The foam targets are attracting attention of researches for their capacity to enable an efficient laser energy absorption in a low density material and a high energy deposition par unit mass.The scientists from GSI, LPI and CELIA are studying foams fro their efficient laser beam smoothing. Within the framework of this project we will study the new technologies of foam fabrication and their doping with metallic nano-particles,develop theoretical and numerical models for their simulations,and study their performance in experiments.This will make an important contribution to the inertial fusion research and new,efficient X-ray sources. The intense laser pulse sources are considered in many laboratories as a means for creation of efficient and flexible sources in the THz domain,which remains actually underexplored.The scientists of IAP and CELIA developed recently a new approach for the generation of intense THz pulses by using a Cherenkov effect from laser pulses

propagating with the light or higher-then-light velocities in air or other gases.This idea allows generating a short pulse in a chosen direction and easily the generation zone.This was already proved experimentally and we will persuade this work on a collaborative basis with the objective to develop an efficient and flexible THz source.

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**NBR: 230778** **ACRONYM: TERACAN** **EC FUND: 86400**

**DG:** REA **Call: FP7-PEOPLE-IRSES-2008** **Thema:** FP7-PEOPLE-IRSES-2008

**Title:** Terahertz applications of carbon-based nanostructures

**Abstract:** Creating reliable portable devices working in the terahertz (THz) range of electromagnetic spectrum is one of the most formidable tasks of contemporary applied physics, with nanostructures being at the heart of the most promising proposals. This project aims at elaborating a general approach to the description of electromagnetic processes in various carbon-based nanostructures, investigating their electromagnetic properties, and developing a physical basis for utilizing these properties in novel THz nanodevices. The complementary characters of the two key factors inherent in solid-state nanostructures, the spatial confinement of charge carriers and intrinsic nanoscale inhomogeneity of electromagnetic fields, drastically modify their electronic and optical properties. Whereas the first factor lies in the focus of current research activity of the nanoscience community, the role of the second factor was underestimated before. The proposed research is focused to fill this knowledge gap for carbon-based nanostructures. As a whole, the project contributes to the novel interdisciplinary research field, the nanoelectromagnetics, which represents a synthesis of macroscopic electrodynamics of inhomogeneous media and microscopic theory of electronic properties of nanostructures. We will study carbon nanotubes (CNTs) and graphene representing latest trends in carbon-based nanotechnology. As shown in our proposal, unique physical properties of these nanostructures provide the basis for novel THz applications. To achieve the ambitious goals of this project, the consortium involves scientists from both electromagnetic and nanostructure communities. Intensive transfer of knowledge between them is essential for success of the project.

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**NBR: 230785** **ACRONYM: NANOMAGNETS** **EC FUND: 50400**

**DG:** REA **Call: FP7-PEOPLE-IRSES-2008** **Thema:** FP7-PEOPLE-IRSES-2008

**Title:** Mesoscale Quantum Dissipation with Applications to Nanotechnolgy

**Abstract:** Quantum dissipation arising from quantum fluctuations and the quantum mechanics of macroscopic variables is important because of the ever decreasing size (mesoscale) of

the nanoparticles used in technology. The most striking example occurs in information storage by magnetic nanoparticles, where the governing factor for magnetisation reversal by macroscopic quantum tunnelling is spin size S. The S dependence, with associated large quantum effects, becomes evermore marked as one proceeds from single domain particles to molecular clusters to single molecule magnets to individual spins. Here in the context of a general investigation of mesoscale quantum mechanics of particles (separable and additive Hamiltonians) and spins it is proposed to generalise Wigner's quasi phase space formulation of quantum mechanics without dissipation (originally used to calculate quantum corrections to classical statistical mechanics i.e. the quantum/classical borderline characteristic of the mesoscale), to systems with non-separable Hamiltonians (spins) including the effects of dissipation to the surrounding heat bath. The results, obtained by (a) matrix continued fraction methods of solution of the appropriate master equations (b) computer simulation and (c) quantum Kramers escape rate theory will be compared with suitable experimental observations of the escape rate and the associated susceptibilities of nanoparticles.

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**NBR: 230790** **ACRONYM: COMPOSITUM** **EC FUND: 451800**

**DG:** REA **Call: FP7-PEOPLE-IRSES-2008** **Thema:** FP7-PEOPLE-IRSES-2008

**Title:** Hybrid Nanocomposites and Their Applications

**Abstract:** The main research objectives of the 4-year joint programme are: • to synthesise and characterise new hybrid composite and functionalised nanomaterials based on oxides, carbons, polymers and natural minerals; • to study their interaction with biological objects and environmental systems; • to elucidate the role of interfacial phenomena in these systems; • to study structure-properties relationship of nanocomposites in specific applications; • to evaluate performance of novel nanocomposites in biological media, environmental systems and specific industrial applications. Other objectives of the proposed collaboration are aimed at: • increasing individual mobility and career prospectives of each person involved; • facilitating transfer of knowledge between research groups involved via exchange visits; • providing training opportunities for early stage researchers; • disseminating results of the joint activities; The joint investigations will be carried out via transfer of knowledge and networking activities between four teams from Member States - Poland, UK, Hungary and Greece, and the National Academy of Sciences of Ukraine, an ICPC country with an economy in transition.

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**NBR: 230791** **ACRONYM: HYANJI SCAFFOLD** **EC FUND: 374400**

**DG:** REA **Call: FP7-PEOPLE-IRSES-2008** **Thema:** FP7-PEOPLE-IRSES-2008

**Title:** Hyaluronan-based injectable material for tissue engineering (HYANJI SCAFFOLD)

**Abstract:** This is an exchange-based programme to enable developing new tissue engineering scaffolds based. It aims at technology transfer of advanced methods from for the biosynthesis of polyalkaonates and for targeted drug delivery. The exchange programme comprises 2 EU partners (Keele and Pisa) and 2 Chinese partners (Tsinghua and Sichuan) who are centres of excellence. The exchange comprises 208 person-months over 4 years to achieve scientific and strategic development of foundation for long-lasting scientific collaboration between EU and China. Scientific novelty lies in the use of biosyntehsised multifunctional nano-process matrices. They will be cultured under dynamic conditions in bioreactor with online monitoring of O2, CO2, and pH. Building these regeneration constructs needs the combination of expertise which is by no means available on one ingle centre. The work is organised into definite but complimentary 4 work-packages (WPs) that are executed by the combined effort of the 4 partners. Each WP has 52 person months. After this project, each partner will have adapted new knowledge, skills and expertise resulting in new innovations in treatment of bone and cartilage defects to transfer to industry for and strengthened EU-Chinese collaboration to catch with existing gap with US and Japan.

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**NBR: 230796** **ACRONYM: NANO-ENAG** **EC FUND: 46800**

**DG:** REA **Call: FP7-PEOPLE-IRSES-2008** **Thema:** FP7-PEOPLE-IRSES-2008

**Title:** USE OF NANOMATERIALS FOR ENVIRONMENTAL AND AGRICULTURAL APPLICATIONS

**Abstract:** The aim of the joint research programme is to study nanomaterials for environmental and agricultural applications. The global objectives of this project will be: 1. to synthesize and characterize low cost nanomaterials such as layered double hydroxides (LDHs) or fine grained poorly crystalline Fe-Al or Fe-Mn oxides. These nanomaterials will be used in native form and complexed with an organic matrix, named polymerin, recovered from olive mill wastewaters (OMW); 2. to study the behavior of nanomaterials for retention of pesticides and biophenols and to develop slow-release formulations of these chemicals, with particular emphasis on assessing their bioavailability; 3. to totally detoxify OMW through fractionation on nanomaterials.

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**NBR: 230802** **ACRONYM: NANOBIOSENS** **EC FUND: 333000**

**DG:** REA **Call: FP7-PEOPLE-IRSES-2008** **Thema:** FP7-PEOPLE-IRSES-2008

**Title:** NANOSENSORS BASED ON NANOMATERIALS

**Abstract:** The primary objective of this proposal is to bring together an international and interdisciplinary group of research teams who have different expertise areas to share the knowledge of different elements for building nano-biosensors. The development of future devices requires controlled assembly and placement of individual and/or multiple nano building blocks into the desired locations. By the accomplishment of this research proposal, the advantages of integration of nanomaterials into the structure of biosensors will be feasible. It is expected that the nanomaterial assembled biosensor structures will show an enhanced sensitivity due to the high surface area, higher porosity, and adjusted surface energy. In this research proposal, there are six participants from six countries with different expertise areas in the field of chemical engineering, biomedical engineering, materials science, physics, chemistry, and biology. Different pieces of work will thus be constructed into each other to first of all study their "separate" roles in that assembled piece of work. The international and interdisciplinary group of research team who came together is composed of Turkey, France, Ukraine, Canada, United States and (Rep. of) Korea. The estimated time of the project is 36 months. The proposed programme consists of three stages. STAGE 1 consists of shortly "synthesis of nanomaterials and their controlled assembly and organization of Si wafer substrates". STAGE 2 is composed of the "biofunctionalization" of these materials built in STAGE 1 and the building a biosensor out of the assembled materials. STAGE 3 will focus on the "field tests" to see how affective these biosensors are working. Six trainings, three general meetings and three workshops are being planned for this research proposal in order to share all the knowledge and information gained throughout the work and to form the basis of long lasting collaborations.

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**NBR: 230832** **ACRONYM: ROBOCON** **EC FUND: 459000**

**DG:** REA **Call: FP7-PEOPLE-IRSES-2008** **Thema:** FP7-PEOPLE-IRSES-2008

**Title:** Routes to Bose-Einstein Condensation at Room Temperature

**Abstract:** Enormous progress in material engineering, research tools and methods very frequently lead to revisiting the traditional topics of Condensed Matter Physics and their study under the very original and unexpected view-point. In the current project we propose to consider the possibility and realization of such textbook phenomena as Bose-Einstein condensation in three, on first glance different systems: 1. Carbon-based systems: Graphite, Graphene and Nanotubes 2. Exciton-Polariton excitations in semiconductors 3. Perovskite Oxides close to Metal-Insulator transition. that, according to the very recent studies demonstrate the very common feature: the Bose statistic of current (mass) carriers and tendency to form the condensed superconducting or/and superflluid state at high temperatures. It is this feature that unify the leading experts on these materials in the proposed Multidisciplinary Marie Curie IRSES project ROBOCON which has the final objective to understand the realization of BEC phenomena on the experimental and theoretical level in the proposed systems and elaborate practical recommendations for

their further applications in High-Tech industry: polariton lasers for CD and DVD players and laser printers, novel Carbon- and Oxide- based microelectronics for computer RAM and CPU devices etc. Basing on this common subject we created the distributed consortium (network) of partner institutions, located in EU (France, UK, Italy) and Eligible Third Countries (Morocco, Brazil). Each of them has its own specialization and related with others by virtue of already existing bilateral collaborative links. In course of the project we suppose to amplify and order these collaborations and create the new links between partners under central common idea of study and optimization of mechanisms and realization of BEC. Series bilateral visits, training workshops and meetings are previewed for this purpose.

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**NBR: 230868** **ACRONYM: MESOPOMS** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-IRG-2008** **Thema:** PEOPLE-2007-4-3.IRG

**Title:** Nanostructured Mesoporous Polyoxometalate and Transition Metal-substituted Polyoxometalate Materials: Applications in Heterogeneous Catalysis

**Abstract:** The synthesis of nanostructured mesoporous polyoxometalates with high internal surface area and ordered or/and hierarchical pore structure remains an open challenge. This proposal aims to the development of such nanostructures. On one hand mesoporous materials with well-defined pore structure and high internal surface area are of great scientific and technological interest because of the possibility of tailoring their pore structure and framework composition. On the other hand metal-oxygen cluster anions of the early transition metals, commonly referred to as polyoxometalates and transition metal-substituted polyoxometalates, are important supramolecular inorganic nanoclusters with wide range of chemical structures and physicochemical properties and, thus attractive for applications such as photocatalysts, redox catalysts, electrochemical sensors and magnetic and optoelectronic devices. It would be very interesting to combine the shape selectivity of a mesoporous solid with the catalytic, optoelectronic and magnetic properties of a polyoxometalate cluster. Polyoxometalate clusters can provide novel building blocks, when they became nanostructured, promising new type of multifunctional nanomaterials We intend to establish new synthetic strategies toward nanostructured polyoxometalate-based mesoporous materials with well-defined pore structure and high internal surface area. For example purely inorganic and organic-supported nanostructured POM-based materials such as SiO2-, TiO2-, Al2O3-, SnO2-POM and {Q}-POM (where (POM= [(Mn,Ni)Mo9O32]6-, [(Co,Zn)PW11O39]5-, [(Eu)W10O36]9- and Q= 4,4-bipyridine, [Ag2(CH3CN)4]2+, (R'O)3SiRSi(OR')3) will be explored. Integration of these POM nanostructures in thin film morphology will also be attempted. The resulted mesoporous polyoxometalates are expected of considerable performance in catalytic applications in reduction-oxidation of pollutant NOx and SOx gases and in epoxidation/oxidation of alkanes and alkenes.

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**NBR: 230876** **ACRONYM: TPN** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-IRG-2008** **Thema:** FP7-PEOPLE-IRG-2008

**Title:** Transport Phenomena at the Nanoscale

**Abstract:** Mass transport through nanoscale pores (i.e. pores in the nanometre size range) has been studied for many years in disciplines as diverse as membrane science, soil permeability and cell physiology. However, in all these fields, though, the emphasis has always been placed on the macroscopic outcome, while the effects on fluid behaviour of intermolecular forces or physical and chemical interactions between the liquid and the solid surface have often been neglected. The primary objective of the proposed research is to understand quantitatively the behaviour of liquids flowing in nanoscale pores. In particular, a focus will be placed on the nature of interactions between liquids and the pore structures. This can be achieved by systematically studying the effect of pore size, shape, surface chemistry and structure on fundamental nanoscale transport phenomena including wall slip, liquid velocity, surface tension and contact angle of liquids. In order to achieve this objective, I propose the development of an innovative fluidic chip that combines nanochannel manufacturing with traditional microfabrication techniques. This capitalizes on my previous experience in the field of nanoporous alumina synthesis and liquid flow through carbon nanotubes. A detailed description of the nanofluidic chip design is provided in the proposal along with details about the fundamental fluid physics phenomena that will be investigated Although the proposed research focuses on the fundamental understanding of liquid behaviour at the nanoscale, the development of the proposed nanofluidic device will have applications beyond the scope and duration of the work proposed here: Understanding the interactions occurring between liquids and the pore walls they flow through represents a key to optimizing the performance of many systems such as water filtration and desalination processes, separation of liquids, and energy storage systems such as supercapacitors.

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**NBR: 230906** **ACRONYM: NANODYN** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-IRG-2008** **Thema:** PEOPLE-2007-4-3.IRG

**Title:** Theory of Dynamical Processes in Semiconductor Nanostructures

**Abstract:** We envision to develop a computational method base on first-principles (i.e., ab-initio) and empirical pseudopotentials that is, unlike any other method, able to treat the relevant size range of semiconductor nanostructres (i.e., between 1000 and one million atoms), on an atomistic footing, including dynamical effects at the many-body level. The

method will be developed following a bottom-up approach, i.e., starting from the most accurate description available such as density functional theory. The vibrational and electronic properties obtained this way for small clusters consitute the back-bone of the method and will be used to construct a robust and accurate desciption based on classical force fields (for the phonons) and semiempirical pseudopotenitals (for the electrons). The results obtained, including electron-phonon coupling, will then be used in a configuration interaction approach that will give us access to the correlated many-body wave functions of the excitation. The developments lean on developments undertaken by the P.I. in the last 6 years and will be accurate and general; being able to deal with arbitrary shapes and a wide range of materials. From the resulting many-body wave functions (including phonons) a wide range of new physical effects will be available, such as electronic relaxation times, spin relaxation times, temperature effects, Raman spectra, Polaron couplings, photon linewidth, which are key components in fields such as quantum information/computing, spintronics, lasers, nano-electronic devices, photovoltaic and even medicine. Besides its relevance for nanotechnology, the development presented here will have a significant impact for basic science research. Many of the concepts valid in solid-state physics are challenged in the nanometer scale and many fundamental discoveries can be expected that cross the boundary of physics to chemistry and biology.

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**NBR: 230943** **ACRONYM: COPET** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-IRG-2008** **Thema:** PEOPLE-2007-4-3.IRG

**Title:** Control of photo-induced energy transfer in functionalized carbon nanostructures towards design of nanoscale applications

**Abstract:** The proposed research project aims at advancing a combined approach of quantum dynamics methodology and quantum control techniques applicable on photo-induced energy transfer processes on nanostructures consisting of carbon nanohorns, or CNHs, and molecular compounds with several stable equilibrium configurations, or MCCs. The ultimate objective of such studies is the design and development of nanoscale devices, such as plastic electronics, solar energy conversion cells, and artificial photosynthetic molecular complexes. For this purpose, we propose to combine the time dependent density functional theory with the Natural Transition Orbitals representation in order to study the electronic transition density which governs the photo-induced energy transfer process between electronic excited states in functionalized carbon nanostructures. The excitonic dynamics will be further investigated with quantum dynamical methods which take into account the coherent excitonic time evolution in interaction with the vibrational degrees of freedom in such systems. The manipulation of the photo-induced transfer process will be achieved by switching on demand between the different equilibrium configurations of the molecular compounds, which often have different physical properties, used for functionalization of the carbon nanohorns, by taylored

laser pulses. Alternatively, the control of the photo-induced transfer process will be achieved by the introduction of metallic nanoparticles in the proximity of the functionalized carbon nanostructures and the resulting near-field effects on the electromagnetic density of states due to the scattered light. The scientific innovation expected, following the successful implementation of the present project, may reveal future technologies based on advanced functional nanoarchitectrures consisting of CNHs and MCCs in the areas of opto-electronics, solar energy conversion cells, and artificial photosynthetic systems.

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**NBR: 230964** **ACRONYM: SOAFNPCM** **EC FUND: 45000**

**DG:** REA **Call: FP7-PEOPLE-ERG-2008** **Thema:** PEOPLE-2007-2-2.ERG

**Title:** Supramolecular Organization and Application of Functional Nanostructures of Phthalocyanine-like p-Conjugated Molecules

**Abstract:** We plan to use supramolecular chemistry and self-assembly as a tool to organize p-conjugated molecules of the family of the phthalocyanines in a controlled way, in order to build well-defined, nanometer-sized functional objects. More concretely, we want to synthesize phthalocyanine-like molecules that are able to aggregate by p-p stacking interactions forming stable nanowires or nanoparticles. These assemblies are expected to have unprecedented physical properties, which will be studied both in solution and in the solid state, our final goal being the incorporation into nanoscale devices for organic photovoltaics, data storage or sensors that yield an enhanced performance and/or derive in novel potential applications.

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**NBR: 230975** **ACRONYM: ERESIN** **EC FUND: 45000**

**DG:** REA **Call: FP7-PEOPLE-ERG-2008** **Thema:** PEOPLE-2007-2-2.ERG

**Title:** Electronic Response of Single Inorganic Nanowires

**Abstract:** Nanoscale integrated electronics requires building blocks with controlled functional properties. In the continuous strive towards higher integration density, an alternative way of connecting transistors inside a chip is needed. Tertiary inorganic nanowires made up of molybdenum, sulphur and iodine (MoSI) provide a straightforward, scalable synthesis and easy dispersability in a variety of solvents without functionalisation or surfactants. Their connectivity to gold nanoparticles enables self-assembly of networks. To date, their conductivity is limited by energy disorder and defects. This process aims at improving the material by investigating the origin of disorder and defects. To this end, both the basic electrical characterisation as well as the study of the electronic relaxation

dynamics via femtosecond spectroscopy will be performed with a spatial resolution down to the individual nanowire. Defects in isolated small nanowire bundles, single nanowires, and networks will be identified with conductive atomic force microscopy. Femtosecond pump-probe spectroscopy using a confocal microscope will be performed on the same samples in order to study the electronic processes of individual nanowires and how they change in the presence of defects and nanoparticle junctions.

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**NBR: 231019** **ACRONYM: NANO-MAT** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-IRG-2008** **Thema:** PEOPLE-2007-4-3.IRG

**Title:** Self-Assembled Nanostructures for Organic-Inorganic Hybrid Nanomaterials

**Abstract:** Bio-inspired self-assembled nanostructures comprises one of the most exciting developments in the fields of chemistry, physics, biology and materials science. These materials are vastly ordered structures with high-aspect ratio and are used as scaffolds to create chemically functionalized surfaces with control at the atomic level. The chemical properties of the materials are highly tailorable based on the choice of organic struts. These remarkable characteristics and properties have interesting applications such as photovoltaic cells, selective catalysis, adsorption, sensing, and bio-recognition. Herein, it is now proposed to extend the range of properties of self-assembled nanomaterials to encompass presentation of chemically functional groups on novel nanostructures. Our design approach relies upon hydrogen bonding, amphiphilic and metal chelating small molecules programmed to form nanostructures upon need. The work to be performed will encompass design, synthesis and characterization of self-assembled nanoscale materials in variuos architectures. Quantitative experimental studies of metal binding capability and systematic experimental use of the nanostructures will be studied for building devices for practical applications. The proposed interdisciplinary studies will accumulate knowledge that may lead to novel highly selective catalytic ensembles, chemical sensors, chemically smart coatings and alternative renewable energy products.

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**NBR: 231036** **ACRONYM: ANDIST** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-IRG-2008** **Thema:** PEOPLE-2007-4-3.IRG

**Title:** Anisotropy Distributions in Nanomagnetic Arrays for Patterned Media

**Abstract:** This proposal is aimed at understanding why nominally identical nanomagnetic elements switch at different values of applied magnetic field, and providing material solutions that will allow the switching field distribution (SFD) to be reduced. The width of the SFD is a

critical problem in any nanomagnetic device that depends for its functionality on reversal of magnetisation, but is particularly pressing in the case of bit patterned media (BPM). BPM is currently a leading contender to become the new paradigm for data storage in the $30bn hard disk drive (HDD) industry when recording on granular, perpendicular media reaches its limit at ~1 Tbit/in2 (~155 Gbit/cm2). The timeliness and relevance of the proposed research is amply demonstrated by the realisation that the best current materials for BPM have an intrinsic distribution of anisotropy that is a factor of two greater than modelling shows is required to successfully build a BPM device operating at 1 Tbit/in2. BPM provides strong motivation of the proposed research, but the benefits for other areas of nanomagnetism are also significant, since it is generally true that as the size of nanomagnetic devices decreases the SFD increases. As an example, successful development of high density Magnetic Random Access Memory (MRAM) will crucially depend on control of the SFD. Hence, if the full potential of nanomagnetism as a practical technology is to be realised, control of the SFD will be a key enabling requirement. The research ideas contained in this proposal are firmly focussed on providing a new and detailed understanding of a critical problem in nanomagnetics. The principal investigator has a significant record of achievement in this important research area, gained while working in the US. The purpose of this re-integration proposal is to provide resources that will allow this extensive expertise and experience to be exploited to the full in a timely fashion.

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**NBR: 231059** **ACRONYM: DECNAHED** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-IRG-2008** **Thema:** PEOPLE-2007-4-3.IRG

**Title:** Development of Composite Nanomaterials for Hydrogen Energy Devices

**Abstract:** This project will deal with development of new materials for emerging hydrogen and fuel cell technologies using nanotechnology approach. Main focus will be to develop low price novel composite inorganic/polymer membranes for electrolyser and fuel cell (PEM/DMFC) applications. The basic approach is to use a novel procedure for double cross-linking of sulfonated PEEK in order to improve the membrane stability and electrochemical performance in FC (patent application is submitted). The synthesis procedure is simple and it will not involve any expensive, and harmful and corrosive components. The membrane will be modified by adding inorganic nanoparticles and blending with polybenzimidazole (PBI). Standard characterization methods for membranes will be applied. Morphological studies and electrochemical and spectroscopic methods will be used as a basic ones for this project. However, from practical point of view the components are embedded in a macrosystems (fuel cell, electrolyser, battery) and they are exposed to real working conditions of device, which might include high electric current flow and high electric field gradient. It is limiting long term stability. About 0.1% power decrease per 1000 hrs is generally accepted for stationary applications, which is difficult milestone for nanomaterials. In this project the

main focus will be on integrated approach. The membrane-electrode assembly (MEA) will be produced and material properties will study from point view of working assembly. In our Project the complex approaches combining aspects of device physics and nanotechnology and using multiphysics modeling will be used to address similar complex problems. Multiphysics modeling software Comsol will be applied in order to specify the device performance conditions and reactor designs under which the MEA degradation is minimized. Effort is planned to link the multiphysics modeling with practical experiment.

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**NBR: 231085** **ACRONYM: ORITUPOCO** **EC FUND: 45000**

**DG:** REA **Call: FP7-PEOPLE-ERG-2008** **Thema:** FP7-PEOPLE-ERG-2008

**Title:** Orientation of Carbon Nanotubes in Polymer Composites

**Abstract:** Proposal plans to prepare well-aligned carbon nanotube (CNT)/polymer composites. The orientation of CNTs will be reached by two ways. By the first way, well-dispersed surface modified CNTs in gel network will be uniaxially stretched and then cross-linked further, to freeze to the oriented system. By the second way, CNTs with photo-active groups at surface will create self-assembled structures in polymer matrix. For this reason, it is necessary to perform surface modification of CNTs. It will be achieved by introducing of functional groups or oligomers miscible with polymer matrix to reach the best compatibility or by introducing the photo-active groups. Author believes that during self-assembly process of photo-active groups attached at nanotube surface they will induce the orientation of CNTs by light. Similar procedure with photo-active groups can be use in case of alignment by uniaxial stretching. For fixation of anisotropy after stretching the photo-active groups can be used again when oriented structure of CNTs is fixed by photocoupling and/or photocrosslinking at different stage of uniaxial stretching. The photocoupling or photocrosslinking produces strong chemical bonds that fix the internal structure of filler inside matrix. In addition the alignment can be affected by concentration of photo-active groups or used light. An influence of various wavelength, irradiation dose and type of polymer matrix on the orientation of CNTs and influence on mechanical and electrical properties of final CNT/polymer composite will be studied. Various optical, mechanical and electrical methods will be used for characterization of prepared composites. All data will be collected at various irradiation doses in order to be able to determine the photo-actuation behavior of composites.The ambitious goal of the proposal is photo-actuation of prepared CNT/polymer composites associated with new functionalization of CNTs.

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**NBR: 231112** **ACRONYM: DIVA** **EC FUND: 45000**

**DG:** REA **Call: FP7-PEOPLE-ERG-2008** **Thema:** PEOPLE-2007-2-2.ERG

**Title:** Genetic DIversity of AVIdins for Novel Biotech Applications

**Abstract:** Avidins are amongst the most widely used proteins in biotechnology, with applications encompassing molecular labelling, purification & detection, as well as uses in diagnostics, targeted drug delivery and nanotechnology, such as enantioselective catalysis by artificial catalysts. Avidins also serve as outstanding model systems for our understanding of biomolecular interactions, through their extremely high affinity for biotin (dissociation constant, Kd≈10−14–10−16 M).and biotinylated molecules. However, despite their importance in biotechnology, only two avidins have found widespread and routine use amongst the scientific community: chicken avidin and bacterial streptavidin. DIVA aims to exploit the recent identification of novel avidins in DNA sequence databases to generate novel variants of these proteins. DIVA will also use protein engineering to provide further genetic diversity, such as defined asymmetric tetramers of avidins consisting of different subunits. The overall aim is to expand the range of avidins available to biotechnologists and to increase their use and potential applications.

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**NBR: 231654** **ACRONYM: EURONANOBIO** **EC FUND: 699999**

**DG:** RTD **Call: FP7-NMP-2008-CSA-2** **Thema:** NMP-2008-1.1-3

**Title:** EUROpean scale infrastructure in NANOBIOtechnology

**Abstract:** EuroNanoBio aims at defining the key features of the future EU capacity in nanobiotechnology and the roadmap to reach this goal. It will establish the features of the infrastructure, the role of the various stakeholders and the way to establish it. This Support Action is divided into three phases: 1) An analytical phase where the existing data, published or not, will be scrutinised and analysed to extract some success factors to be used for defining the EU infrastructure in nanobiotechnology. This analysis is conducted in four directions • existing top class infrastructures or clusters inside and outside Europe • modes of technology transfer from research to industry • multidisciplinary education and training • ancillary aspects of nanobiotechnology. 2) A building and consensus phase where many diverse stakeholders who play a role in the EU capacity in nanobiotechnology are invited to jointly defined and adopt the key features of the infrastructure, and the way to build it 3) A dissemination phase where the former results will be widely disseminated using Internet and a large dissemination event. The EuroNanoBio partners are highly experienced in EU integration in nanobiotechnology in general as well as in specific aspects studied in the CSA. They have unrivalled access to a wide panel of stakeholders in governments, industry, education, regulation, ethics. The consortium will act as a catalyst for these stakeholders to collect their contribution and make them build together the roadmap for establishing the EU capacity in nanobiotechnology.

**NBR: 231986** **ACRONYM: AMETHYST** **EC FUND: 819104**

**DG:** REA **Call: FP7-SME-2008-1** **Thema:** SME-1

**Title:** Ambulatory Magneto-Enhancement of Transdermal High Yield Silver Therapy

**Abstract:** There are approximately 2 million people who suffer from chronic wounds such as venous leg ulcers in Europe at the present time. These wounds typically take between 12 and 24 weeks to heal, but 30% take over two years. This represents a cost to the European healthcare services of at least €8 billion a year in treatment. Two thirds of cases are released immediately for treatment in the community, and it is common for 40% of community nurses' time to be taken up by the management, dressing and care of this type of wound. In addition to the above, one of the reasons behind the phenomenon of antibiotic resistant bacteria is the widespread use of medication when there is no clinical infection. If low level silver ion dressings could be used in prophylaxis instead of antibiotics there would be an additional saving in terms of the cost of treating patients who contract antibiotic resistant infections. More importantly the incidence of antibiotic resistance will be lower. Current wound treatments are either expensive, inadequate or dangerous. Our idea provides a way of enhancing the effectiveness of silver-containing dressings used in the treatment of ulcers by creating a pulsed electromagnetic field at the wound site by the incorporation of a pulsed electromagnetic element in a low silver dressing. The pulsed electromagnetic field increases the concentration of silver ions available to the wound bed margin. The device is designed to be worn by patients in their every-day lives without the need to attend a medical facility for treatment. The system consists of two distinct components – an electronic pulse generator and an electromagnetic component contained in a disposable surgical dressing which is impregnated with silver-containing nanoparticles.

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**NBR: 232100** **ACRONYM: NANOSCRATCH** **EC FUND: 620926**

**DG:** REA **Call: FP7-SME-2008-1** **Thema:** SME-1

**Title:** To develop a scratch resistance coating using a molecular self assembly nanotechnology for plastic products

**Abstract:** The project aims to develop a novel high performance scratch resistant coating technology for plastic pieces at a low cost using an environmental friendly and tailor-made process, over a broad range of plastic materials. These coated plastics can substitute weighty materials, as metallic or glassy components, and high cost engineering plastic materials. The new coating technology to develop is based on self

assembly nanotechnology. Nowadays, plastic materials present limited scratch and mar resistance when compared with materials as ceramics, glass or metals. After a short period of use, plastic parts surface is damaged and aesthetically defects appear (blisters, cracks, scratches…). Scratches can be an ideal breeding ground for bacteria, reducing the hygienic properties of plastics materials. These negative properties limit the usability of these materials in a broad range of applications and leading companies are making constant efforts to overcome this problem. NANOSCRATCH approach will provide a novel technology based on the facts that the surface of certain plastics can be modified through a mild oxidation and chemical functionalization process, using self-assembled molecules. This new technique will provide an effective bond between the plastic surface and the nanoparticle coating, due to a highly cross-linked network formed at the surface, avoiding the traditional adhesion problems of coatings applied onto plastics, due to its low polarity, while maintaining the aspect of the original part. The new technique involves three steps: mild oxidation, self-assembly and co-deposition of nanoparticles. Among the main potential applications, the project will focus on high scratch resistance plastic pieces for the automotive industry and white-goods appliances manufacture in order to replace weighty, expensive and non-recyclable Engineering Thermoplastics and glass by PP filled grades, transparent plastics (mainly PC) and ABS

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**NBR: 232164** **ACRONYM: BIO-CT-EXPLOIT** **EC FUND: 925737**

**DG:** REA **Call: FP7-SME-2008-1** **Thema:** SME-1

**Title:** Innovative simulation tool for bone and bone biomaterials, based on enhanced CT-data exploitation

**Abstract:** The use of computer tomography (CT) imaging is steadily increasing in the ever growing bone implant/surgery and tissue engineering market, although commercial exploitation of CT data for structural design purposes is still based on trial-and-error approaches. This is because X-ray attenuation information is reduced to geometric grey level evaluation. However, on the academic stage, a transnational team of highly esteemed applied physicists, material scientists, engineering mechanicians, and mathematicians has recently pioneered concepts for extraction of chemical information from CT, and of its conversion, via micromechanics laws, into object –specific, inhomogeneous and anisotropic material properties. We here propose R+D activities to substantiate this cutting-edge knowledge into unparalleled, highly reliable simulation tools for structural design purposes. Most of the work load related to these R+D activities will be carried by the RTD partners, which will (upon reimbursement) transfer the simulation tools to four highly innovative SME partners covering all aspects of the bone biomaterial/surgery preplanning market, being leaders in the fields of biomaterial production, of micro and nano-CT scanner development, of image-to-geometry/mesh conversion, and of Finite Element simulation technologies. As a result of the R+D activities being carried out in close cooperation with SMEs, the latter will be, upon completion of the project, the

owners of ready-to-use software packages tailored to SME-specific needs, with rapid time-to-market characteristics. The uniqueness of these products will tremendously improve the strategic market positions of the SMEs, which are expected to generate annual revenues being already multiples of the singular EC contribution – when just considering the submarkets of preplanning dental/orthopaedic surgery and bone tissue engineering research. This will trigger SME growth rates exceeding 30%, both in turnover and employment.

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**NBR: 232522** **ACRONYM: SENSBIOSYN** **EC FUND: 945860**

**DG:** REA **Call: FP7-SME-2008-1** **Thema:** SME-1

**Title:** Biosensors and Sensors for the industrial biosynthesis process of widely used commercial antioxidants: nutraceuticals as additives for food and aquaculture promoting public health and safety.

**Abstract:** The purpose of this 2-years project is to develop sensors and biosensors for on-line monitoring growth parameters of industrial bioprocesses for the production of algal biomass and antioxidant compounds such as Xanthophylls. As a model for the design and in-field testing, the following industrial process and culture system have been selected: the natural production of Astaxanthin from the green microalga Haematococcus pluvialis in a tubular photobioreactor. Key parameters such as biomass, pigment content and accumulation profile during the induction process are now experimentally determined offline everyday at commercial production sites by means of complex manual analyses. This routine monitoring further increases production costs, being critical time consuming and requiring manpower. This is a major challenge faced by microalgae companies today, especially in the production of natural carotenoids in comparison with the relatively cheap synthetic analogues. SENSBIOSYN intends to offer a solution to the lack of existing devices able to provide online rapid automatic and reliable information on active compounds accumulation profile and efficacy during their biosynthesis. The proposed project will bring the following competitive advantages to microalgae companies: Increased production - online monitoring will ease decision about time of harvest and culture performance; Reduction of production cost - the introduction of the proposed biosensors in the process control will allow to save work time and manpower and reduce the production cost by at least 30%, which is a big industrial breakthrough. Two optical sensors, for chlorophyll fluorescence measurement and culture medium density, and two electrochemical biosensors, based on the direct measurement of Phosphatidylcholine peroxidative damage by screen printed electrodes and the PSII activity by nanowire FETs, will be manufactured.

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**NBR: 232603** **ACRONYM: FUNENTECH** **EC FUND: 1166616**

**DG:** REA **Call: FP7-SME-2008-1** **Thema:** SME-1

**Title:** Study of functionality, nutritional and safety aspects of liquid foods, liquid food preparations and cosmetics processed by ultra-high pressure homogenisation

**Abstract:** FUNENTECH intends to reinforce technology transfer of Ultra High Pressure Homogenising (UHPH) processing to SME of liquid-food and cosmetic sectors. The Consortium is constituted by five SME and four RTD partners: Stansted Fluid Power Ltd (UHPH equipment); Nectina S.A. (vegetable milks); NAHO Cosmetics (innovative cosmetics); ABbiotics (biotechnology); Universitat Autònoma de Barcelona (UAB), Université Montpellier II (UMII) and Federal Centre for Nutrition and Food (FRCNF), and commits to exploit and disseminate the knowledge generated taking into account intellectual property rights agreed. The RTD institutions gather proved experience in the application of non-thermal technologies, food safety, chemistry, technology, nutrition and toxicology. The main objectives are: to study the (techno-) and biological functionality of UHPH-processed foods and cosmetics to design functional foods of high safety and nutritional values, and to target specific industrial adaptation of the prototypes for food and cosmetic production in two years time. It is also aimed at providing valid information to policy regulatory bodies and consumers. It is expected to obtain novel products with improved functional characteristics (better stability during storage; longer shelf-life; reduced immunoreactivity; containing nano and micro transport-delivery systems of bioactive-compounds; excellent organoleptic characteristics) that build up national and trans-regional new markets niches for the SMEs involved.

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**NBR: 232942** **ACRONYM: NANO-DYN-SYN** **EC FUND: 3100000**

**DG:** ERCEA **Call: ERC-2008-AdG** **Thema:** ERC-AG-LS5

**Title:** Nano-Scale Organization Dynamics and Functions of Synapses: from single molecule tracking to the physiopathology of excitatory synaptic transmission

**Abstract:** Synapses are arguably the most elaborate signaling machine of cells. This complex intercellular junction is specialized for rapid (millisecond) directional signaling. In addition, synapses change in response to patterns of neural activity and these changes can endure, modifying neuronal circuitry. These competing properties of persistence and plasticity must be encoded by the precise content and arrangement of molecules that comprise the presynaptic and postsynaptic specializations. The objective of this project is to uncover the internal organization and dynamics of the postsynaptic specialization at excitatory glutamatergic synapses of the mammalian brain at an unprecedented nano-scale resolution. For this aim, neurobiologists, physicists and chemists join forces in a team with proven track record of collaboration. We will

combine cellular and molecular neurobiology approaches with development of novel optical technologies, biosensors and combined quantitative light and electron microscopic imaging techniques. This will provide a new level of analysis to the fundamental problem of molecular information storage. Photothermal imaging of nano-gold particles will allow unprecedented quantitative histochemistry and tracking of protein trafficking up to the level of intact tissue. Development of Cryo-Photoactivated Light Microscopy will allow the correlative localization of synaptic elements at the light and electron-microscopic level. Novel biosensors and chemical tools will be developed for the investigation of the dynamic macromolecular events underlying synaptic plasticity. We will identify new mechanisms that control fast synaptic transmission and its long term activity dependent modification. We will unravel how fast receptor diffusion controls frequency dependent synaptic transmission and how regulation of receptor trafficking participates in synaptic plasticity.

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**NBR: 232952** **ACRONYM: NANOIMMUNE** **EC FUND: 2499424**

**DG:** ERCEA **Call: ERC-2008-AdG** **Thema:** ERC-AG-ID1

**Title:** Nanoparticle Vaccines: At the interface of bionanotechnology and adaptive immunity

**Abstract:** We have recently developed a bionanotechnology approach to vaccination (Reddy et al., Nature Biotechnology, 25, 1159-1164, 2007): degradable polymeric nanoparticles are designed that: (i) are so small that they can enter the lymphatic circulation by biophysical means; (ii) are efficiently taken up by a large fraction of dendritic cells (DCs) that are resident in the lymph node that drains the injection site; (iii) activate the complement cascade and provide a potent, yet safe, activation signal to those DCs; and (iv) thereby induce a potent, Th1 adaptive immune response to antigen bound to the nanoparticles, with the generation of both antibodies and cytotoxic T lymphocytes. In the present project, we focus on next-generation bionanotechnology vaccine platforms for vaccination. We propose three technological advances, and we propose to demonstrate those three advances in definitive models in the mouse. Specifically, we propose to (Specific Aim 1) evaluate the current approach of complement-mediated DC activation in breaking tolerance to a chronic viral infection (hepatitis B virus, HBV, targeting hepatitis B virus surface antigen, HBsAg) and to combine complement as a danger signal with other nanoparticle-borne danger signals to develop an effective bionanotechnological platform for therapeutic antiviral vaccination; (Specific Aim 2) to develop a new, ultrasmall nanoparticle implementation suitable for delivery of DNA to lymph node-resident DCs, also activating them, to enable more efficient DNA vaccination; and (Specific Aim 3) to develop an ultrasmall nanoparticle implementation suitable for delivery of DNA to DCs resident within the sublingual mucosa, also activating them, to enable efficient DNA mucosal vaccination. The Specific Aim addressing the oral mucosa will begin with HBsAg, to allow comparison to other routes of administration, and will then proceed to antigens from influenza A.

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**NBR: 232959** **ACRONYM: NANOTHERAPY** **EC FUND: 2000000**

**DG:** ERCEA **Call: ERC-2008-AdG** **Thema:** ERC-AG-LS7

**Title:** A Novel Nano-container drug carrier for targeted treatment of prostate cancer

**Abstract:** The essence of the proposal is the fabrication of multiple nano containers which exhibit double and triple stimuli response and site recognition. Specifically, the containers will be grafted by Leuprolide (LP) for prostate cancer recognition. Multiple containers will be filled by two drugs (e.g. LP and DOX) in different compartments not interacting with each other chemically (cocktail of drugs, e.g. Container1 Leuprolide (LP) and Container2 Doxorubicin (DOX)). The release can be excited by internal or external stimuli response. The internal stimuli response of our nanocontainers will require simultaneous recognition of pH, redox and/or T of the tumour. The external induction will be caused by RF excitation (hyperthermia). The nanocontainers will identify the tumour first by the agonist (LP). After trapping the container at the tumour, they will be activated by the double and triple internal excitation. This way, we achieve extremely local chemotherapy of the diseased site and the healthy organs will be untouched. Our smart nanocontainers will be tuned for prostate cancer, but our system will be evaluated for other cases such as breast cancer and thrombosis. The containers will be modified (phase transition, volume change, degradation, etc.) and deliver the drug only and if only the two sensors give positive response. The containers can be excited by external induction (Radio Frequency (hyperthermia) RF or laser light). This revolutionary strategy is necessary because the externally induced delivery methods have the disadvantage that the radiofrequency fields, the magnetic fields and the laser lights are not local but they extend over large space, larger than the size of the tumour. One cannot focus from outside the laser beam directly to the tumour only may be due to lack of imaging facilities. Our technology will prevent the release of drugs in sites where the local values correspond to the healthy tissue.

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**NBR: 233161** **ACRONYM: MSOT** **EC FUND: 1999992**

**DG:** ERCEA **Call: ERC-2008-AdG** **Thema:** ERC-AG-LS7

**Title:** Next Generation in-vivo imaging platform for post-genome biology and medicine

**Abstract:** With re-defined challenges in post-genome biology and medicine related to understanding the regulation and function of genes, proteins and multi-factorial disease, the development of accelerated and quantitative in-vivo observation of functional -omics at different system levels becomes a vital target. This proposal offers to develop

therefore a next-generation biomedical imaging platform, designed to radically impact biomedical and drug discovery applications. The imaging strategy aims at resolving powerful optical reporters (fluorescent proteins, nanoparticles, optical probes) with 10-100 micron resolution and femptomole sensitivity through several millimeters to centimeters of tissue. This performance brings unprecedented ability to non-invasively visualize biological and molecular processes in-vivo in intact organisms over time. To achieve these goals, the proposal considers first the development of multi-spectral opto-acoustic tomography (MSOT) as a high performance method for revolutionizing biomedical imaging. Then, the proposal offers to develop powerful application areas in visualizing functional –omics, disease growth and drug effectiveness. The advancements offered herein can become a highly preferred biomedical imaging modality while offering ground-breaking imaging performance, safe non-ionizing radiation, an easy to disseminate platform, and unparalleled flexibility in capitalizing on powerful optical contrast using molecular reporters.

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**NBR: 233227** **ACRONYM: HIDDENTIMENMR** **EC FUND: 2212000**

**DG:** ERCEA **Call: ERC-2008-AdG** **Thema:** ERC-AG-LS1

**Title:** NMR detected nanosecond to microsecond dynamics for biomolecular recognition dynamics

**Abstract:** NMR spectroscopy detects in a unique way with atomic resolution biomolecular dynamics in the previously hidden time range between approximately 5 nano- to 50 microseconds (ns-ms time range). The detection of this motion happens in equilibrium under physiological conditions without the need for a triggering reaction. On the example of ubiquitin, this dynamics was found by us to be important for molecular recognition between proteins implying conformational selection rather than induced fit. Only free solution ensembles including this dynamics accessed the full conformational heterogeneity of structures in recognition complexes. Molecular dynamics analysis suggests high correlation of these ns-ms dynamical modes. Here, we propose to establish with NMR experimentally the correlated nature of the ns-ms dynamics, to describe ensembles reflecting ns-ms and sub-ns dynamics by separating the time scales. In this context, using temperature jump-infra-red spectroscopy and solid state NMR we want to determine the time scale of the ns to ms motion more precisely. Since the ns-ms time scale is slower than diffusion, dynamics on this time scale could be a mechanism of regulating or limiting the kinetics of molecular association and recognition. Therefore, we want to determine on-rates by NMR spectroscopy and want to explore whether mutants that do not affect the binding interface but will affect the dynamics modulate the on-rates. This would allow the control of binding kinetics and explore the influence of ns-¼s dynamics on protein-protein recognition on the long run also for membrane proteins. In addition specificity for drug interactions could be increased addressing extremal conformations present in the ns-¼s ensembles for homologous proteins with

otherwise very similar average structures at interaction interfaces. If the proposal is successful this would open up new opportunities for drug design and design of protein-protein interactions.

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**NBR: 233253** **ACRONYM: MEMBRIDGE** **EC FUND: 268000**

**DG:** RTD **Call: FP7-NMP-2008-CSA-2** **Thema:** NMP-2008-2.6-3

**Title:** Bridge between environment and industry designed by membrane technology

**Abstract:** Membranes are nano-/micro-porous multifunctional materials the main property of which is permselectivity regarding to different ionic and molecular species. This property results in a great number of applications in processes of aqueous and gaseous mixture separation. The small material and energy consumption and high eco-efficiency of separation by membranes determine strategic role of membrane processes as technologies making a bridge between industry and environment. The main objective of the proposal is to make a step towards reaching an effective integration of research activities, training, equipment sharing, and thus answer the needs for a coordinated membrane science and technology R&D in Europe and Russia oriented primarily at development of eco-efficient methods in industry. This objective replies to one of most important priorities of FP7: Elaboration of concepts aimed at sustainable development, and societal innovation. This objective will be attained by rapprochement of two membrane networks: Network of Excellence NanoMemPro in Europe and Russian Membrane Network being in the way of formation. The project foresees the organisation of two meetings of 25 representatives of European institutions belonging to NanoMemPro and of the equivalent number of Russian and NIS scientists. The basis for a European-Russian Membrane Science and Innovation Technology Platform will be founded as well. As a result of the project, a well structured programme/concept of scientific collaboration and diverse actions (in the field of researches, training, equipment sharing, person mobility, technological innovation) for the next several years will be elaborated. The proposed project should prepare grounds for further larger and amplified actions between European and Russian membrane networks following the axe of environmental protection, in the framework of FP7 and other international and regional programmes.

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**NBR: 233433** **ACRONYM: NANOYOU** **EC FUND: 1453449**

**DG:** RTD **Call: FP7-NMP-2008-CSA-2** **Thema:** NMP-2008-1.1-2

**Title:** Communicating NANOtechnology to European YOUth

**Abstract:** NANOYOU will design and undertake a communication and outreach program in nanotechnology (NT) aimed at European youth. The project will reach 11-18 year olds through school programs to take place in at least 20 EU Member States and Associated States. Additional programs aimed at young adults aged 19-25 will be offered in science centres. The school programs are planned to involve at least 400 schools and reach more than 25,000 students. The science centres program is expected to reach an initial 4,000 young adults during NANOYOU and many more subsequently as more science centres adopt the program. Recent surveys show that most European citizens have poor understanding of NT, its potential and risks. This needs to be rectified if the European public is to contribute positively to future decision-making about the use of NT. In focusing on ages 11-25, NANOYOU recognizes that effective programming needs to be tailored to the educational capabilities and interests of the target population. Programming specialization will be provided for subgroups within this youth population. While some FP6 programs have made an excellent start in informing the public about NT, they have not focused on youth nor have their activities taken places in the schools. NANOYOU will combine temporary exhibitions, innovative computer games, experiments and other online content, with workshops aimed at promoting dialogue that will raise participants' awareness of ethical, legal and societal aspects of NT. NANOYOU's content will be balanced and up-to-date, and teacher training materials will be prepared to equip science teachers and other personnel to present the NANOYOU programs. NANOYOU has assembled a strong consortium with partners experienced in nanotechnology, educational methodology and science communication, as well as organizations highly suited and experienced at arranging outreach/communication activities in schools and science centres

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**NBR: 233466** **ACRONYM: EICOON** **EC FUND: 729998**

**DG:** RTD **Call: FP7-NMP-2008-CSA-2** **Thema:** NMP-2008-2.6-3

**Title:** Euro-Indo forum for nano-materials research coordination & cooperation of researchers in sustainable energy technologies

**Abstract:** In a globalized world energy is a decisive factor for the further development and economic and social well being of the nations and stability in the different world regions. Materials science and research has in the past significantly contributed to solving issues in sustainable energy technologies. To bring about advancement and improvements in energy technologies and to address sustainability, research in nano-materials is expected to contribute significantly to solutions in a highly competitive and increasingly globalize world. Such research will inevitably have to be coordinated at European level but also internationally. In Europe, materials researchers cooperate increasingly in EU funded projects and bilaterally with non-European countries. The EU has concluded S&T agreements and implementation arrangements with India. It foresees the coordination and the execution of joint projects. This proposal intends to address the strategic

assessment including synergy analysis of nano-materials research needs in the EU and India. It will establish and communicate to DG RTD and DST the mutual interests and the topics for future coordinated calls to enable the decision & policy makers and the funding bodies to make better informed decisions and to better select the implementation mechanisms and instruments. Beside the assessment, the proposal also addresses the dissemination of the "nano-materials research acquis" in the field by organization of events. Finally, it will bring together researchers for future research collaboration, to exchange ideas for joint projects and to inform each other on their core competencies & expertise. The project aims at the generation and enhancement of knowledge in materials science and research especially nano-materials applied to sustainable energy technologies. It also aims to increase the deployment of these materials in the technologies in both regions.

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**NBR: 233467** **ACRONYM: EULASUR** **EC FUND: 999817**

**DG:** RTD **Call: FP7-NMP-2008-CSA-2** **Thema:** NMP-2008-2.6-3

**Title:** Network in Advanced Materials and Nanomaterials of industrial interest between Europe and Latin American Countries of MERCOSUR (Argentina-Brazil-Uruguay)

**Abstract:** A key thrust of FP7 is to promote international collaborative research with third countries. The EULASUR project will address the Call for Co-ordination Action in Materials by creating a cooperation platform for forming strategic research partnerships between scientists, policy makers, technology transfer and industrial experts in the EC and 3 Latin-American countries belonging to MERCOSUR: Brazil, Uruguay and Argentina (BRAU). Research topics will be identified within the fields of i) advanced functional ceramics and ii) hybrid materials and nanomaterials where significant opportunities exist for mutually beneficial actions between the two regions. The goals are designed to gain first hand knowledge of the state of the art research in these fields through summer schools, exchanges and partnership actions. The project will also address the social, political and cultural factors impacting technology transfer and collaboration between the EU and BRAU countries. The core activities of EULASUR are based on some research Groups of Excellence that already cooperate bilaterally and will integrate them with additional groups to generate a stable, integrated scientific platform of international excellence interested to collaborate in the development of materials research in specific topics of interest to both regions. The EULASUR partnership is composed of 15 research centres, 8 from Europe and 7 from BRAU countries selected on the basis of: excellence in research, complementary skills and access to national and international R&D policy makers. Government representatives will participate in the EULASUR Advisory Board. Industrial companies and technological centres are expected to take part in the project activities. EULASUR has 5 WPs. 3 designed to build contacts and identify opportunities, 1 to disseminate results to key stakeholders and policy makers and 1 management and

progress measures. Each WP has two WP Leaders: one from BRAU and the other from the EU.

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**NBR: 233473** **ACRONYM: NANOTOTOUCH** **EC FUND: 1367516**

**DG:** RTD **Call: FP7-NMP-2008-CSA-2** **Thema:** NMP-2008-1.1-2

**Title:** Nanosciences Live in Science Centres and Museums

**Abstract:** The NANOTOTOUCH proposal aims to create innovative environments for the broad public to learn about and to discuss nano research by directly involving the actors of research themselves. We propose to do this by taking the laboratory environment and the research work out of enclosed academic campuses and relocating them right in the midst of the public in science museums and science centres. Three science museums and three science centres will closely cooperate with local university partners to create three permanent Open Nano Lab locations (in Munich, Milan and Gothenburg) and three Nano Researcher Live areas (in Mechelen, Tartu and Naples). In these places the visitors will experience “live” the day-to-day practices and processes of nano research conducted by young scientists. This peer-to-peer dialogue on an equal basis between lay public and nano-researchers not only creates a bidirectional feedback, it also minimises the expert-to-lay bias (“top-down" approach) inherent present science communication processes with authoritative top researchers. In order to prepare the young scientists for this novel method of communication, NANOTOTOUCH also includes a strong communication skills training component. NANOTOTOUCH will also establish new role models for choosing science as a career: young adults thinking of entering science will be able to discuss various aspects with young researchers who themselves made this decision recently, whilst upcoming researchers will learn that communication is a self-evident part of their professional identity. Thus, NANOTOTOUCH pushes science communication to its extreme, merging communication and research in a powerful way and responding to the need for more transparency and accessibility in science. Furthermore, the strong synergetic network approach of the project enables contents and models to be developed for further distribution and implementation in educational and scientific communities.

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**NBR: 233476** **ACRONYM: NANO2MARKET** **EC FUND: 689997**

**DG:** RTD **Call: FP7-NMP-2008-CSA-2** **Thema:** NMP-2008-1.2-4

**Title:** Best Practices for IPR and Technology Transfer in Nanotechnology Developments

**Abstract:** The lack of models for technology transfer at nanotechnology developments is of increasing concern for the sector. This CSA will fulfil this gap providing guidelines for technology transfer and rules for IPR and license agreements in nanotechnology developments. To achieve these objectives, a consortium is formed by: 1) Key European research centres in different areas of nano and converging technologies, 2) Outstanding agencies for IPR advice, 3) Market analyst experts,industry associations and venture capitals, as end clients of IP. Constructing value chains of the transfer of each technology the consortium will analyse specific applications of the different areas of the nanotechnology R&D European strategy: medical applications, information technologies, energy, materials, manufacturing, instrumentation, food, environment and security. Our objective is to classify the technology application areas of nanotechnology into different clusters according to: development costs, market time, complexity of licensing, etc. In parallel, a mapping of the technology and actual and forthcoming market will be analysed according to: competitiveness, geographical area, development potential, risks etc. Specific data mining tools will help to conclude the key worldwide actors of development and commercialisation of the different technologies. Also, actual IPR cultures and technology transfer rules will be listed according to the features of their market and technology. Matching these IPR technology transfer models with the concluded value chains and market and technology mapping, will allow concluding business models and setting efficient rules for technology transfer. All models will be discussed at consortium seminars, where general algorithms are expected to be excerpted. Specific guidelines will be given for research institutions and SMEs for efficient transfer of their prototypes to the market, along with a focus for the valorization of EU FP7 funded research projects

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**NBR: 233481** **ACRONYM: TIME FOR NANO** **EC FUND: 1473600**

**DG:** RTD **Call: FP7-NMP-2008-CSA-2** **Thema:** NMP-2008-1.1-2

**Title:** TIME for Nano - Tools to Increase Mass Engagement for Nanotechnology

**Abstract:** The TIME for Nano Project aims at engaging the general public, with a special attention to young people, on benefits and risks related to nanoscale research, engineering and technology, through specific informal education products, namely the nano-kit and the organisation of a web contest each year that will be the basis for the realisation of events and debates for the public and collecting opinions and feedbacks from the participants. The products will use an inquiry-based learning approach, specifically developed in science centres/museums, where people understand by doing. The nano-kit could contain e.g. small exhibits, nano-objects and materials, scripts for experiments and role/team game cards. It is a tool for stimulating the participation of youngsters in the nano-olympics and for engaging in debate scientists, stakeholders and the public in general. The web platform will be a resource centre and an attractor for the whole community of N&N communicators, through its contents (continuous addition of new

information etc), its innovative tools ( web contest) and the artistic approach, the online feedback collection. A great added value of the project is that of “growing” a community of people engaged in N&N communication, through the realisation of training courses in each of the participating Science Centres (at national level) and by Ecsite (at European level) intended to reach a number of at least 450 multipliers (experts working in outreach and education efforts), carefully chosen among three main groups: explainers in science centres and PhD students in science communication; teachers from primary and high schools. The public participation to the web-contest is ensured by the organisation of many events in science centres of 9 countries each year: launch event, nano days, final event with award prizes, intended as occasions for informing/educating, on one hand, and for engaging youngsters, collecting perceptions and opinions, on the other.

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**NBR: 233482** **ACRONYM: HYPOMAP** **EC FUND: 899958**

**DG:** RTD **Call: FP7-NMP-2008-EU-India-2** **Thema:** NMP-2008-2.6-2

**Title:** New materials for hydrogen powered mobile applications

**Abstract:** Emission-free energy generation in mobile applications is one of the major challenges to science to reduce global warming. A particularly promising approach is the electrochemical oxidation of hydrogen in fuel cells. Two challenging questions have to be solved to achieve this goal: Hydrogen has to be stored at reasonable volumetric and gravimetric storage capacities in materials which allow efficient, energy-neutral loading and unloading. The released hydrogen must be oxidized electrochemically to produce electric power and water, the only by-product of this process. We will investigate various strategies to store hydrogen in nanoporous materials and by chemisorption in various hydrides. Special emphasis is given to the mechanism of adsorption, the thermodynamics of the ad- and desorption process, tuning of the materials etc. For studies on chemisorption, materials shall be searched with a suitable energy balance between hydride and dehydrogenated species. The reaction mechanisms will be studied in detail and tuning of reaction barriers by advanced catalysts shall be investigated. The studies include various known and advanced materials such as carbon nanostructures, metal organic framework materials (MOFs), covalent organic framework materials (COFs), boron nitrides, clathrate hydrates and metal clusters. While present fuel cell technologies are more advanced than hydrogen storage devices, there is still room for significant improvements. We will investigate new proton conducting materials for high- and low-temperature fuel cells, based on perovskites and new inorganic nanomaterials like imogolite derivatives (HT) and organic substances (LT). Investigations will include a wide range of theoretical approaches, including ab initio quantum chemistry, density-functional theory, quantum-liquid density functional theory for hydrogen, molecular dynamics and Grand-Canonical Monte-Carlo simulations

**NBR: 233484** **ACRONYM: MACAN** **EC FUND: 1099813**

**DG:** RTD **Call: FP7-NMP-2008-CSA-2** **Thema:** NMP-2008-2.6-3

**Title:** MERGING ATOMISTIC AND CONTINUUM ANALYSIS OF NANOMETER LENGTH-SCALE METAL-OXIDE SYSTEMS FOR ENERGY AND CATALYSIS APPLICATIONS

**Abstract:** The stability of thin films in contact with different materials is a critical issue for a wide range of modern devices, including high-k films in the microelectronics industry, metal electrodes for fuel cells, and nanometer sized particles on oxides for catalysis. Some groups are working on thermodynamic analysis of thin film stability, who correlate relative interface energies with dopant adsorption. While this provides important thermodynamic parameters which can be used to evaluate the stability of thin films, information on the detailed atomistic structure and chemistry of the same interfaces needs to be correlated with the thermodynamic approach. Other groups use advanced characterization approaches to determine local atomistic structure and chemistry, and theoretical groups explore interface structure and energy through computational methods. It is the goal of this project to bridge between these working groups. This project will establish an environment to promote communication and collaboration between groups using thermodynamic approaches with groups studying the atomistic structure of interfaces, since bridging this particular scientific gap has the potential to result in new design criteria for advanced material systems. The project is based on a core group of European, and International partners, who have realized that such a form of communication is critical to advancing the field of interface science and interface based technology. The partners will establish structured programs for discussion via focused public workshops and summer schools, and via scientific exchange. While the core group of partners is academic, European industry will be involved in the structured discussions. The expected impact from this four-year project is methods to correlate between thermodynamic analyses of interfaces with atomistic structure. This will provide new approaches to understanding interface stability, adhesion and interface dependent functional properties.

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**NBR: 233485** **ACRONYM: ENF 2009** **EC FUND: 394300**

**DG:** RTD **Call: FP7-NMP-2008-CSA-2** **Thema:** NMP-2008-4.0-10

**Title:** Organization of the Conference EURONANOFORUM 2009 "Nanotechnology for Sustainable Economy"

**Abstract:** The conference EuroNanoForum 2009 will be established as a foremost European congress in Nanotechnology within the framework of the Czech presidency. The conference will address the impact of nanotechnologies on sustainable economy focusing on their applications in resource- and eco-efficient industrial production, environmental protection and remediation, and energy production and conservation in the coming years. It aims to: (i) present the nanotechnology state of the art in the realm of sustainable economy;(ii) facilitate intensive exchange of views, information and experience between researches and representatives of industry, investors as well as policy makers and representatives of civil society; (iii) foster networking and knowledge transfer between different national and European stakeholders; and (iv) promote responsible governance in nanotechnology.

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**NBR: 233486** **ACRONYM: NANO-TV** **EC FUND: 702500**

**DG:** RTD **Call: FP7-NMP-2008-CSA-2** **Thema:** NMP-2008-1.1-2

**Title:** Enhancing public awareness on the results of European research actions on Nanosciences and Nanotechnologies through the professional use of television media and the internet

**Abstract:** The strategic objective of NANO-TV is "TO CONTRIBUTE TO THE DEVELOPMENT OF PUBLIC AWARENESS ON EUROPEAN RESEARCH ON NANOSCIENCES AND NANOTECHNOLOGIES IN ALL EUROPEAN COUNTRIES THROUGH THE PROFESSIONAL USE OF TELEVISION MEDIA AND THE INTERNET". The project will: • Highlight the key results from the Nanotechnologies Theme. • Create a series of 14 high-quality free-of-rights Video News Releases (VNRs) for the general public on the basis of the key results of the research. • Include all 14 released VNRs into the broadcasting mainstream of the European TV stations by implementing a consolidated communication model involving the totality of the national European TV media. • Establish a sound science-based dialogue on nano issues by introducing all released VNRs and the associated written materials (articles, press releases, etc.) into a series of highly references internet platforms. • Monitor the results of the project and assess its achievements and success, by assessing the overall impact of the project and collecting actual broadcasts made by European TV stations and include them on a DVD at the end of the project, for future use and exploitation. The expected measurable results of NANO-TV are: • To have each of its audiovisual production broadcast by at least 10 major national TV stations throughout Europe. • To reach an overall public TV audience of several tens of millions people. • To track as many broadcasts as possible and to retrieve, for each broadcast, broadcasters' edit. • To provide a measure of the overall media impact of the project.

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**NBR: 233502** **ACRONYM: AMCOS** **EC FUND: 520000**

**DG:** RTD **Call: FP7-NMP-2008-EU-India-2** **Thema:** NMP-2008-2.6-2

**Title:** Advanced Materials as CO2 Removers: A Computational Study of CO2 Sorption Thermodynamics and Kinetics

**Abstract:** The proposed work aims at developing the tools required for the intelligent choosing and tuning of nano-porous materials with respect to a specific application. For this purpose, a combined computational theoretical and experimental study is envisaged in order to digitally reconstruct the porous matrix of selected advanced materials, mainly for applications involving sorption of carbon dioxide and methane by employing advanced Statistical Mechanics based computer simulation methods, both, in atomistic (Monte Carlo, ab initio and equilibrium and non-equilibrium Molecular Dynamics) and mesoscopic level (Kinetic Monte Carlo and Lattice Gas Cellular Automata). The reasoning behind this strategy is that the structure of materials spans a wide range of length scales, making thus sorption and transport phenomena depend upon length and time scale. As a consequence, the proposed computational methodology consists of many levels in order to address properly these phenomena. Moreover, a complementary approach to computer simulations is provided through direct comparison of two highly sophisticated methods for measuring motion of guest molecules inside porous materials, namely, quasi-elastic neutron scattering (QENS) and pulsed field gradient nuclear magnetic resonance (PFG NMR), carried out by the groups of Lyon and Leipzig respectively. This type of combined studies can be perfectly utilized through the proposed work towards a fascinating insight of the relation of the material interior to the sorption and transport mechanisms of sorbates such as carbon dioxide and methane, both involved in the so-called greenhouse effect.

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**NBR: 233513** **ACRONYM: MONAMI** **EC FUND: 930000**

**DG:** RTD **Call: FP7-NMP-2008-EU-India-2** **Thema:** NMP-2008-2.6-2

**Title:** Modeling of Nano-scaled Advanced Materials Intelligently

**Abstract:** The proposed consortium focuses on a collaborative effort of developing novel techniques and paradigms concerning theoretical modelling of nano-scale advanced materials. The objectives are to identify novel methodologies and to identify appropriate approximations to successfully undertake simulations of the materials which are to be used in our future society. An important aspects here is to be able to carry out this development all the way from ide and concept to working computer soft-wares. In addition to this technical development we will focus on establishing knowledge concerning an emerging class of materials; nano-scaled materials with potential for tailored properties and potential for novel functionality. Training of younger scientists forms a natural aspect of this ambition, and is a strategically relevant outcome of our

planned efforts. Finally, it is envisaged that the collaboration will enable an intensified collaboration between European and Indian research laboratories and universities.

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**NBR: 233533** **ACRONYM: INFORM** **EC FUND: 1700000**

**DG:** RTD **Call: FP7-NMP-2008-CSA-2** **Thema:** NMP-2008-2.6-3

**Title:** Integrating Nanomaterials in Formulations

**Abstract:** A coordination action is proposed to reinforce the international dimension of EU research on nanomaterials in formulations in the Asia-Pasific region. Three mechanism will be implemented to reach the widest possible audience in the appropriate formats that are convenient to the different stakeholders: (1) yearly major events, that will introduce a new concept to scientific gatherings and a departure from conventional meetings, (2) a researchers exchange program to seed new collaborations, facilitate joint projects and the realisation of future coordinated calls, and (3) the creation of a website devoted to nanomaterials in formulations, that will include up to date and reliable information on the newest research developments, funding opportunities, regulations, events and links to other nanotechnology initiatives.

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**NBR: 233552** **ACRONYM: DYNAMAG** **EC FUND: 899936**

**DG:** RTD **Call: FP7-NMP-2008-EU-India-2** **Thema:** NMP-2008-2.6-2

**Title:** ADVANCED COMPUTATIONAL STUDIES OF DYNAMIC PHENOMENA IN MAGNETIC NANO-MATERIALS

**Abstract:** The opportunity to modify the excitation spectra in materials with modulated properties has stimulated striving research activity in the area of artificial nanostructures with novel functionalities - so called metamaterials. Magnetic materials with modulated properties also possess properties that cannot be reduced to those of their constituents. The best example is the phenomenon of giant magneto-resistance (GMR), the discovery of which was marked by the Nobel Prize in Physics last year. Similar to photons in photonic crystals, the spectrum of magnons (spin waves) in periodic magnetic nano-materials shows a tailored band structure. The latter consists of bands of allowed magnon states and band gaps in which there are no allowed magnon states. By analogy to studies of other band-gap materials, the field of research is called magnonics. Further development and application of magnetic nano-structures requires a thorough understanding of the relation between their physical and chemical structure and useful magnetic functionalities. The ability to accurately predict properties of fabricated magnetic nano-structures and complete devices theoretically would generate huge

savings of resources, but remains illusive at present. The goal of this project is to consolidate efforts of European and Indian researchers with a broad range of leading expertise to create, to validate and to implement a flexible computational framework for modelling of dynamics in realistic magnetic nano-materials and complete devices. The framework will be validated via comparison of computational results against those obtained experimentally or using analytical theories. We will model magnetic dynamics in topologically complex nanostructures, in view of applying them in design of realistic devices. This project will provide a computational foundation for creation of not only novel high speed magnetic technologies but also of those at interfaces with photonics, plasmonics, phononics, and electronics.

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**NBR: 233826** **ACRONYM: TIFFE** **EC FUND: 2042075**

**DG:** RTD **Call: FP7-SST-2008-RTD-1** **Thema:** SST.2008.1.1.1.

**Title:** Thermal Systems Integration for Fuel Economy

**Abstract:** The project is devoted to the development of an innovative Integrated Vehicle Thermal System based on the integration of vehicle thermal systems to improve the on board thermal management and the energy efficiency. The major project contents are: - Dual loop air conditioning: one loop to transfer the cooling power and one loop to reject the heat - Two-levels temperature heat rejection system: one temperature to reject the high temperature heat (e,g. engine waste heat) and one temperature to cool locally the vehicle auxiliary systems - Innovative heat exchangers: new generation of compact fluid-to fluid heat exchangers and application of innovative technologies for fluid-to-air heat rejection - Use of innovative coolants (e.g. Nanofluids): to improve the heat rejection and redesign the heat exchangers TIFFE benefits can be summarised in a Cost Reduction (due to resize of the systems and their integration) and Fuel Economy increase of 15% on real use thanks to the: - improvement of the aerodynamics due the new front end design - increase of auxiliary systems efficiency thanks to the local cooling - engine overall efficiency thanks to a fine control of heat exchange, local cooling (turbocharge, fuel, ...) and improvement of the engine intake - the reduction of engine re-starts on Hybrid or Stop&Start vehicle due to cabin thermal comfort: the dual loop air conditioning with a designed thermal inertia guarantees thermal comfort when the thermal engine is off - compact Refrigeration Unit compliant with Low GWP refrigerants – R744 or flammables (e.g. R152a, R1234yf) Two prototypes will be realised and validated: • a gasoline passenger car with Stop & Start function • a diesel Light Commercial Vehicle with hybrid power train Both will undergo to a complete series of road and climatic chamber tests and a long range road test - e.g. from Catania (I) to Cape North (N) - to verify the reliability and effectiveness of the system and to promote its exploitation.

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**NBR: 233859** **ACRONYM: QUEVADIS** **EC FUND: 1000000**

**DG:** CNECT **Call: FP7-ICT-2007-C** **Thema:** ICT-2007.8.0

**Title:** Quantum Engineering via Dissipation

**Abstract:** Due to the ongoing miniaturization of devices, one of the central challenges of the 21st century's technology will be to handle quantum effects at the nanoscale. A first fundamental paradigm shift happened in the mid '90s when it was realized that quantum effects, which from the traditional point of view put fundamental limits on the possible miniaturization, could be exploited to do information theoretic tasks impossible with classical devices. The main obstacle in building such quantum devices however is the occurrence of decoherence, by which coherence within the quantum device gets degraded due to the coupling with the environment. In this proposal, we propose a second paradigm shift by demonstrating that one can actually take advantage of decoherence if engineered in a smart way. The central focus will be the study of quantum processes driven by dissipation, and we will investigate whether quantum coherence and the associated applications can actually be driven by decoherence. The main tools that we plan to use to achieve that goal originate from the theory of quantum entanglement. The timing of this innovative project is actually perfect as the field of entanglement theory is just mature enough to pursue the ambitious goals stated in this proposal. The main objectives of this proposal are 1. to set up a rigorous mathematical framework for studying fixed points and convergence rates of dissipative processes; 2. to investigate how highly entangled quantum states arising in strongly correlated quantum systems or in a quantum information theoretic context can be created by dissipative processes; 3. to study quantum devices powered by dissipation such as quantum memories and quantum Metropolis devices; 4. to use such devices to come up with novel ways for implementing quantum computation in the presence of decoherence; 5. to study non-equilibrium phase transitions driven by dissipation and associated to that new possible phases of matter.

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**NBR: 233883** **ACRONYM: TAILPHOX** **EC FUND: 2111088**

**DG:** CNECT **Call: FP7-ICT-2007-C** **Thema:** ICT-2007.8.0

**Title:** TAILoring photon-phonon interaction in silicon PHOXonic crystals

**Abstract:** TAILPHOX project addresses the design and implementation of Silicon phoXonic crystal structures that allow a simultaneous control of both photonic and phononic waves. The final goal is to push the performance of optical devices well beyond the state of the art by this radically new approach. By merging both fields (nanophotonics and nanophononics) within a same platform, novel unprecedented control of light and

sound in very small regions will be achieved. The project will cover from the development of theoretical and numerical tools to deal simultaneously with light and sound to the application to three high-impact scenarios in the field of ICT: i) phonon-assisted light emission in Silicon, ii) control of photon speed (delay and storage) by SBS in Silicon photonic chips, and iii) realization of highly-sensitive dual phoXonic sensors.

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**NBR: 233950** **ACRONYM: UNITRIDE** **EC FUND: 1408076**

**DG:** CNECT **Call: FP7-ICT-2007-C** **Thema:** ICT-2007.8.0

**Title:** Unipolar Nitride Photonic Devices

**Abstract:** This project aims at investigating the building blocks of an emerging semiconductor technology for high-performance photonic devices operating in the near infrared (NIR). We will make use of nitride semiconductors [Ga(In)N/Al(Ga,In)N] and engineer the electronic quantum confinement at the nanometer scale to realize unipolar devices relying on intersubband (ISB) transitions. While the existing NIR optoelectronic technology is dominated by InGaAsP/InP or GaInAs/GaAsSb-based interband devices, nitride ISB devices will provide superior performance and novel functionalities like wavelength tunability, speed, high power and temperature handling capabilities, temperature insensitivity and material hardness. It is important to outline the novelty of the research in nitride ISB devices, a technology whose performance capabilities and intrinsic limits remain unknown. Our approach consists in applying novel design concepts and recently-acquired know-how on nitride molecular beam epitaxy to the realization of nitride ISB devices with unprecedented performance. The project includes the development of innovative devices which have not been investigated so far, such as electro-optical ISB phase modulators or nitride-based unipolar lasers. The ultimate deliverables are ultra-high-speed electro-optical modulators, photodetectors and lasers. Establishing a new state-of-the-art for design, growth and processing of nitride heterostructures, and developing an advanced know-how on nitride devices are major challenges. The consortium regroups four world-class academic experts on nitride technologies, ISB devices and NIR optoelectronics. The strategy has been designed based on a careful assessment of the risk associated to all tasks. This project is expected to generate strong impacts in terms of photonic applications and IPR issues.

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**NBR: 233992** **ACRONYM: QNEMS** **EC FUND: 2449218**

**DG:** CNECT **Call: FP7-ICT-2007-C** **Thema:** ICT-2007.8.0

**Title:** Quantum Nanoelectromechanical Systems

**Abstract:** In this project, we will investigate the quantum properties of nanoscale mechanical resonators. Suspended structures will be made of Al, SiN, GaAs, carbon nanotubes, and photonic crystals, covering frequencies in the MHz and GHz range. The vibrations will be excited by electrical means. To overcome the thermal noise, cooling of the low-frequency resonators will be performed. We will use two cooling techniques: sideband cooling due to the coupling to an electromagnetic resonator, and optical cooling. For the ultra-sensitive read-out of the displacement, optical methods will be used, as well as a novel technique based on incorporating the resonator into an arm of a superconducting interference device (SQUID). A part of the project will be devoted to developing methods of quantum manipulation with mechanical vibrations. Successful implementation of the project will require integration of mechanical and optical devices into nanoelectronic circuits. A close collaboration of theorists and experimentalists is essential for the success of the project. The theoretical research will concentrate on modeling cooling and read-out schemes by considering interaction of electrons with non-equilibrium phonons and photons. The project addresses basic research; mid-term and long-term applications are expected in the areas of sensing and quantum information.

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**NBR: 234324** **ACRONYM: 2020 INTERFACE** **EC FUND: 2591690**

**DG:** RTD **Call: FP7-SST-2008-RTD-1** **Thema:** SST.2008.1.1.1.

**Title:** Tailoring of Tribological Interfaces for Clean and Energy-Efficient Diesel and Gasoline Power Trains

**Abstract:** Durability and friction control in internal combustion engines is currently delivered from a complex package of lubricant additives in a fully formulated engine oil. These oil additives, through tribochemical interaction with the surface, produce nanostructured composite, self-healing and smart tribofilms at the surface. 2020 Interface involves the design of the complete system; functionalised Diamond-like Carbon (DLC) coating and future generation lubricant to enable the Europe's stretching targets in fuel economy and durability to be met. There has been much emphasis in research on designing new coatings technology such that the degree of complexity of surface systems has increased dramatically over the last decade. In boundary lubricated contacts, it is the interfacial nanostructured film, which results from tribochemical interactions between the surface and the lubricant additives, which dictates the system performance. No attempts have been made to incorporate "design" strategies into optimizing this interface and 2020 Interface tackles this through an interdisciplinary integrated experimental and theoretical approach. The benefits of this approach are accrued from substantial improved fuel economy (protection of natural resources), reduced emissions (protection of the environment) and improved durability (lower waste and maintenance). As the number of vehicles in the globe increases year on year without showing signs of reaching a plateau and the internal combustion engine remains the major platform for

powertrain for the foreseeable future, the impact of this project will be large and long lasting. 2020 Interface brings together a world class consortium of 4 Universities, 1 research institute and 4 leading multinational companies from 8 EU countries together in complete supply chain to deliver fast track radical innovation in nanoscience through to a full set of novel lubrication technology platforms, for commercial applications in diesel and

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**NBR: 234333** **ACRONYM: IAPETUS** **EC FUND: 2339595**

**DG:** RTD **Call: FP7-AAT-2008-RTD-1** **Thema:** AAT.2008.1.1.2.

**Title:** INNOVATIVE REPAIR OF AEROSPACE STRUCTURES WITH CURING OPTIMIZATION AND LIFE CYCLE MONITORING ABILITIES

**Abstract:** Bonded composite patches are ideal for aircraft structural repair as they offer enhanced specific properties, case-tailored performance and excellent corrosion resistance. Bonding further eliminates stress concentrations induced from mechanical fastening of metal sheets, seals the interface, and reduces the risk of fretting fatigue between the patch and the component. IAPETUS focuses on the use of improved composite repair systems offering (i) the introduction of new on-aircraft simplified curing technologies, (ii) enhanced fatigue and damage tolerance properties and (iii) integrated damage sensing. This will be performed via the incorporation of carbon nanotubes (CNTs) both in the composite matrix of the repair patch as well as in the adhesive. The use CNT modified repair concept will lead to improved performance in the blunting of stress concentrations in the parent surface and the inhibition of crack propagation, leading to enhanced fatigue resistance at the locus of the repair as well as for the patch itself. At the same time, the patch repair acquires additional functionalities. The CNT doped Carbon Composites can be tailored to reduce the galvanic corrosion in repaired Aluminium structures. As the patch becomes electrically and thermally conductive thermal energy can be infused in the patch either by direct resistance heating (using the patch itself as heating element via the application of electrical voltage) or by induction heating, to instigate a uniform matrix polymerization since the patch system appears improved thermal conductivity too. The electrically conductive percolated network can be employed to assess the damage within the patch and its interface with the repaired structure, as conductivity changes mirror the damage in the doubler/substrate system by tracing micro damage through breaches in the CNT network; thus, the structural efficiency monitoring at any stage in the service life of the aerostructure can be assessed non-destructively.

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**NBR: 234418** **ACRONYM: ADMIENV** **EC FUND: 45000**

**DG:** REA **Call: FP7-PEOPLE-ERG-2008** **Thema:** PEOPLE-2007-2-2.ERG

**Title:** Advanced Electron Microscopy techniques applied to catalytic materials for energy generation with very low environmental impact.

**Abstract:** The use of novel electron microscopy related techniques is necessary to understand the structure of modern catalysts and, as a consequence, to improve their performance. The installation and development in the University of Cadiz of two novel techniques, Electron Tomography and quasi in situ Microscopy will help to achieve this goal. Electron Tomography is able to unveil the three dimensional structure of functional objects, with sizes in the nanometer scale. This technique will be applied to the study of the morphology and crystallography of nanoparticles. Quasi in situ Microscopy allow the study of the structure and composition at subnanometric scale of different materials in particular chemical states after chemical reactions without being exposed to the atmosphere. These techniques will be applied to the study of catalytic systems based in cerium oxide with gold as the active phase main component used for selective oxidation of CO. New formulations will be tested, including mixed oxides as support and including a second metal in the active phase.

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**NBR: 234798** **ACRONYM: PNPCS** **EC FUND: 237485**

**DG:** REA **Call: FP7-PEOPLE-IEF-2008** **Thema:** FP7-PEOPLE-IEF-2008

**Title:** Purely Nonlinear Photonic Crystals

**Abstract:** Photonic crystals are materials patterned with periodic dielectric structures. Since they were first proposed, in 1987, they have grown into a burgeoning research field with a rich spectrum of applications. Recent research in the field has been rapidly expanding to include nonlinear effects. Combining the compact formats and versatility of photonic crystal structures with the functionalities of optical nonlinearities could ultimately prove to be the key to tunable all-optical devices with huge impact across a broad range of disciplines, from telecommunications and quantum computing, to biology and sensing. Traditional approaches to nonlinear photonic crystals involve micro- (nano-) structuring the linear properties of a nonlinear medium. The research I wish to pursue through an IEF with the world-leading group on nanostructured ferroelectric optical materials would reverse this paradigm, to explore a brand new class of 2D periodic structures, i.e. Purely Nonlinear Photonic Crystals (PNPCs), based on micro- (nano-) structured nonlinearities. Key to the project will be the development of an integrated nonlinear nano-photonic platform in lithium niobate, a ferroelectric crystal in which the sign of the nonlinearity can be periodically modulated in space and exploited in integrated optical formats. The development of a such a nonlinear technology toolkit would enable a new class of 'parametric' photonic crystals which could manipulate all-optically the pathway, pulse shape, delay, spectrum and phase of multicolour light beams by means of purely

nonlinear mechanisms (not via interference and diffraction as in ordinary photonic crystals). This could open a completely unexplored realm, holding promise for excitingly new physics and unprecedented possibilities for device engineering.

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**NBR: 234808** **ACRONYM: ORGANIC ELECTRONICS** **EC FUND: 237283**

**DG:** REA **Call: FP7-PEOPLE-IOF-2008** **Thema:** FP7-PEOPLE-IOF-2008

**Title:** OPTIMIZATION OF ORGANIC THIN-FILM TRANSISTORS FOR PLASTIC ELECTRONICS: TOWARDS TRANSPARENT COMPONENTS IN NEW DEVICES

**Abstract:** Transparent electronics is an emerging new technology which utilizes “invisible” electronic and optoelectronics circuits. To obtain these circuits, the transistor building blocks materials: semiconductor, gate dielectric and conductor must be optically transparent, raising a true grand challenge. The great problem is that conventional organic semiconductors strongly absorb in the visible and few exhibit acceptable TFT performance when processed from solution. This makes clear that there are great opportunities to develop high-performance materials for the fabrication of optically transparent, mechanically flexible optoelectronics. The main goals of this project are: - Develop high-performance, solution-processable, optically transparent organic semiconductor and dielectric materials. - Establish/implement solution deposition/printing processes to achieve multilayers materials deposition with high resolution. - Enable fully transparent, flexible, solution-processed organic TFTs and circuits. - Enable transparent displays. - Analyze the key parameters determining the TFT response. To achieve these tasks, we will carry out these technical goals: - Synthesize and/or optimise new high band-gap molecular and polymeric semiconductors based on rylene, oligothiophene and dicyanomethylene-containing cores. - Functionalize high-purity single-wall carbon nanotubes (SWCNTs) with semiconducting surfactants. - Optimize formulations for solution deposition, focusing on spin-coating and ink-jet printing. - Optimization of layer-by-layer self-assembled nanodielectrics (SANDs) to enhance transparency. - Print crosslinked polymeric dielectric materials on optically transparent substrates. - Evaluate materials performance in various TFT structures on glass substrates. - Characterize spectroscopically and quantum-chemically semiconductors and gate dielectrics. In my work programme, partial objectives can also constitute research items themselves, opening new

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**NBR: 234810** **ACRONYM: COMPLOIDS** **EC FUND: 4714765**

**DG:** REA **Call: FP7-PEOPLE-ITN-2008** **Thema:** FP7-PEOPLE-ITN-2008

**Title:** Physics of Complex Colloids: Equilibrium and Driven

**Abstract:** With progress in nanotechnology, biophysics, and polymer synthesis, colloidal science has reached a new level of importance. A large variety of complex colloids of different shapes, with binding specificity, and variable softness has been synthesized, opening quite exciting ways for engineering materials at the nanoscale. The purpose of COMPLOIDS is to obtain a fundamental understanding of the Physics governing the self-organization and the dynamical behavior of complex colloidal particles in the bulk, under confinement and out of equilibrium. For this purpose, the partners will consider a variety of novel, experimentally accessible colloidal systems that share the common properties of anisotropy, associativity and softness of their constituent particles. A well-coordinated combination of experiment, theory and simulation will explore the fundamental Physics, define similarities and differences between the systems considered and search for common underlying mechanisms of self-organization that are distinct to these complex and highly versatile colloidal systems. The technical objective of COMPLOIDS is to apply the gained knowledge with the goal of engineering novel materials in close collaboration with participating high-technology EU-companies. Young researchers will also profit from COMPLOIDS in a variety of ways. They will be exposed in high-level research working, within a highly connected and interdisciplinary team of researchers and developing state-of-the art tools in the Statistical Physics of Soft Matter. Further, they will attend world-rate graduate programs and courses in the participating academic partners and they will obtain hands-on experience of the industry sector through the participation of industrial partners.

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**NBR: 234811** **ACRONYM: EURONANOMED** **EC FUND: 1332494**

**DG:** RTD **Call: FP7-ERANET-2008-RTD** **Thema:** NMP-2008-4.0-13

**Title:** EUROpean network of trans-national collaborative RTD in the field of NANOMEDicine

**Abstract:** Nanomedicine is an emerging field with a large potential for developing public welfare and economic growth. Critical issues for bringing up this potential in Europe concern especially the maturity of the economic players and their capability to move effectively innovation from knowledge to industrial technology and to clinical and public health applications. Industrial players need therefore to collaborate closer with scientific partners and with clinicians. The second issue is the ability of companies to establish multidisciplinary networks with the research and the clinician communities, increasing their efforts towards biological preclinical and clinical validations. This will shorten the delay for patients to benefit from the innovation and increase the competitiveness of European actors. Therefore EuroNanoMed targets the creation of a mechanism to support trans-national collaborative RTD projects between academic laboratories, companies, especially SME's, and clinicians/public health setting, in the field of Nanomedicine, using a bottom up approach. In consequence, EuroNaNoMed will

develop coordinated European-wide programmes based on common joint transnational calls and funding. The thematic of these two calls will focus on the strategic research priorities of the European technology platform “Nanomedicine”: diagnostics, targeted delivery and regenerative medicine. EuroNanoMed achieves an effective critical mass: the 19 participating national/regional programmes expect to dedicate significant budget to the calls, approximately 15-20% of the sum of their national/regional Nanomedicine budgets. The Long Term Vision of EuroNanoMed is the design of a European-wide integrated programme with a coordinated funding. Potential scenario for implementation will be suggested.

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**NBR: 234841** **ACRONYM: DROSOFORCESPOLARITY** **EC FUND: 169284**

**DG:** REA **Call: FP7-PEOPLE-IEF-2008** **Thema:** FP7-PEOPLE-IEF-2008

**Title:** Locally generated forces within an epithelium: how do they affect the morphogenesis and planar cell polarity?

**Abstract:** My objective is to understand how localized cortical actin/myosin contractility in individual cells within the Drosophila wing hinge and wing blade combine to generate the epithelial remodelling and convergence-extension movements that occur throughout the tissue. In particular, I will examine the role of the planar cell polarity proteins in generating and/or responding to these forces and test the hypothesis that convergence-extension movements are driven by external stretching forces caused by hinge contraction. To do so, I will use a multidisciplinary approach, including both genetics and biophysics. I will combine the genetic tools of Drosophila, to manipulate gene activity in time and space, with long-term time lapse imaging and automated image analysis, developed only recently in the Eaton lab, to quantitatively describe the effects of genetically induced cortical perturbations on cell behaviour. I will myself develop a completely novel method to exert controllable forces on wing tissue in vivo by directing the production of magnetic nanoparticles in specific regions of the wing. The originality of this project lies not only in its conceptual novelty, but in the powerful combination these methods and physical modelling that will be exploited to address the problem.

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**NBR: 234860** **ACRONYM: MIA-CP** **EC FUND: 237595**

**DG:** REA **Call: FP7-PEOPLE-IOF-2008** **Thema:** FP7-PEOPLE-IOF-2008

**Title:** Mechanically Interlocked Actuating Conjugated Polymers

**Abstract:** This proposal details the preparation of novel electromechanical polymers based on mechanically interlocked molecules. These synthetic muscle-like fibres would function via entirely new mechanisms of actuation and have potential applications in the medical, engineering and nanotechnology sectors. In general terms the overall project aim is to couple the latest catalytic mechanical bond-forming methodologies with recent advances in conjugated polymer synthesis to formulate a new generation high performance electromechanical materials. This multidisciplinary research programme integrates aspects of organic, supramolecular and physical chemistry together with materials science. The project objectives will be achieved via a three phase research programme that combines realistic project milestones with focused training activities in materials processing and analysis. The research would be carried out by a promising European scientist at MIT, USA under the supervision of Prof. Swager and at the University of Edinburgh, UK in the group of Prof. Leigh. The researcher's previous experience in organic/supramolecular chemistry and successful academic track record would be exploited during the initial phase of the project and then complemented by intensive training in polymer preparation, processing, analysis and electromechanical device testing. The advanced training provided by the outgoing host would then be applied during the reintegration period through mentoring and collaborative activities. Overall this research programme would facilitate scientific advances at the interface between molecular devices and materials science, foster collaboration between world leading groups in the US and Europe and would effectively bridge the gap between the researchers current position as a skilled research scientist and a position of complete academic independence and professional maturity.

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**NBR: 234920** **ACRONYM: NANOSOLD** **EC FUND: 232837**

**DG:** REA **Call: FP7-PEOPLE-IIF-2008** **Thema:** FP7-PEOPLE-IIF-2008

**Title:** A Chemical Approach to Lead-free Nanosolders

**Abstract:** Physical, electronic and thermodynamic properties of small particles (nano-particles) differ significantly from those of the bulk materials, and the depression of the melting temperature below the melting point of the bulk has been known for a long time. This dependence of the melting temperature on the particle size is not restricted to any particular material and may therefore also be exploited to lower the melting temperatures of lead-free solders. At the same time, the high-temperature solders currently in use (melting temperatures 250-400°C) contain high amounts of lead and are exempt from the European RoHS directive due to reliability reasons. In the search for lead-free substitutes, Sn-Sb and Sn-Sb-M alloys have been identified as possible candidates. With the envisaged reduction of the grain size into the nanometer range and a corresponding lowering of the melting temperature, considerable energy savings would become possible in the first soldering step without sacrificing the stability of the obtained solder junctions against re-melting in the further assembling procedure.

Therefore it is proposed to prepare micro- and nanosized particles of lead-free high-temperature solder materials, based on Sn-Sb-M (M=Ag, Cu, Ni) from suitable chemical precursors. These precursors will be prepared by precipitation reactions, followed by thermal decomposition and, if necessary, by adequate reduction reactions, and the reaction conditions will be optimized. The particles will be characterized by chemical analysis, SEM and TEM, and by thermo-analytical methods, and the corresponding properties will be compared with those of bulk materials. At the same time, additional experiments in the bulk systems Sn-Sb-Ag and Sn-Sb-Cu will be performed to complete the available literature information on phase diagram and thermodynamics. It will be attempted to model the phase diagrams for bulk and for nano-sized materials by the well known CALPHAD-method.

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**NBR: 234970** **ACRONYM: NANOCTM** **EC FUND: 2466208**

**DG:** REA **Call: FP7-PEOPLE-ITN-2008** **Thema:** FP7-PEOPLE-ITN-2008

**Title:** Nanoelectronics: Concepts, Theory and Modelling

**Abstract:** The NanoCTM network will tackle major challenges in the theory of nanoelectronics. Ten internationally-leading European theory-of-condensed-matter groups from nine different countries [including one of Europe's leading industrial electronics-research groups (QinetiQ)] have joined forces as full participants, combining theoretical expertise in nanowires, quantum dots, carbon-based electronics, and spintronics, along with interaction and proximity effects in small dimensions. Our highly-integrated approach to nanoscale transport will represent a major step towards the realisation of future scalable nanotechnologies and processes. In the longer term, the insights gained will contribute to the fabrication of novel functional nanoscale architectures and their integration into a higher hierarchical level. System parameters such as electric field, light, temperature or chemical reactivity are envisaged as possible drivers of future nanoelectronic devices.

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**NBR: 234989** **ACRONYM: MNT-ERA.NET II** **EC FUND: 1333000**

**DG:** RTD **Call: FP7-ERANET-2008-RTD** **Thema:** NMP-2008-4.0-15

**Title:** Micro and Nano Technologies for a new highly competitive European industry

**Abstract:** • MNT-ERA.NET II will improve the coordination between funding programmes, research organisations and industries and secure durable cooperation between key actors from national and regional funding systems. It will promote the convergence of MNT programmes, the streamlining of procedures, and the efficient use of resources, thereby

reducing the fragmentation of European funding instruments. The value of programmes for end-users will increase due to a close interaction with European industry, exploiting strategy papers and roadmaps (such as the MINAM SRA). • MNT-ERA.NET II will aim at the best possible integration of regional and national strategies with European needs and visions by setting up a joint RTD programme, ensuring complementarities with other funding instruments. This will help to reduce cross-European programme duplication and to overcome barriers to entry, enabling the rapid dissemination of research results and exploiting the scientific, technological and innovative impact of public investment in RTD. This will be of particular value for regions and countries that are catching up in terms of research investment and performance. Innovative joint calls, operated in a variable geometry approach, will be widely promoted among the target groups, especially high-tech SMEs. They will reflect the needs identified by the European R&D community, thus opening an attractive and efficient tool for transnational RTD. • MNT-ERA.NET II will therefore stimulate the increased and more rapid uptake of new micro- and nano-technologies within Member states industry. It will support the broad implementation of decisive knowledge for high added-value products, processes and applications and provide strategic and practical contributions to enhancing the competitiveness of the European industry. • MNT-ERA.NET II will prepare an ERA NET PLUS to achieve maximum impact of joint programming by mobilising substantial funding from member states and the EC.

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**NBR: 235018** **ACRONYM: CHIRALIX** **EC FUND: 234448**

**DG:** REA **Call: FP7-PEOPLE-IIF-2008** **Thema:** FP7-PEOPLE-IIF-2008

**Title:** Heterometallic and mixed valence â€œChirale magnetic bricksâ€• in assembler of Single Molecule and Single Chain Magnets for nano-dimension magnetic materials.

**Abstract:** The aim of this project is to develop new molecule based magnetic materials (SMM and SCM) using “chiral magnetic bricks”. The overall purpose of the proposal is to expand the researches toward new compounds with polynuclear and nano-dimensional character as well as with peculiar magneto-chiral properties. The following main research topics will be developed as parts of this project: i) synthesis of new bicompartmental chiral Schiff and Mannich-based ligands; ii) template synthesis of “chiral-magnetic bricks” with SMM behaviour; iii) assembly of “chirale magnetic bricks” by using the free radicals to yield polynuclear heterometallic and mixed valence compounds; iv) understanding the impact of chirality in magnetic properties of building block units and their multidementional networks.

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**NBR: 235064** **ACRONYM: MUSTSOLVIT** **EC FUND: 229154**

**DG:** REA **Call: FP7-PEOPLE-IIF-2008** **Thema:** FP7-PEOPLE-IIF-2008

**Title:** Multi-scale Computational Tool for Self-Consistent Calculations of Thermodynamic and Electronic Properties of Nanosized Solutes

**Abstract:** The ultimate goal of this proposal is to develop a multi-scale computational tool for selfconsistent calculations of the electronic structure of nanosized solutes and the density distribution of solvent molecules around them. The aim of the project is to combine the advantages of the reference-interaction-site-model-self-consistent-field (RISM-SCF) methodology with the power of multi-scale algorithms based on wavelets. The proposed development of the wavelet solver for the RISM-SCF equations should essentially contribute to the state-of-the-art of the integral equations theory for molecular liquids. Hierarchal algorithms used in the approach can convert the original concept into a powerful computational tool and will allow me to construct a robust computational scheme for the self-consistent-field calculations. These findings together with the novel method of extracting and parameterization of the data on the bridge functional will make realistic accurate calculations of various properties of nanosized solutes. The output of the project will be a library of programs available in a timely and user-friendly manner to all potential participants. The developed computational tool bridges the gap between quantum and statistical mechanics, providing a deep insight and understanding on detailed arrangements of the electron and the solvent distributions. When partnered with linear scaling algorithms for quantum calculations, the method will yield chemists an ability to design novel materials with an unprecedented degree of control.

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**NBR: 235086** **ACRONYM: MEMORY QUANTUM ICT** **EC FUND: 160996**

**DG:** REA **Call: FP7-PEOPLE-IEF-2008** **Thema:** FP7-PEOPLE-IEF-2008

**Title:** INFORMATION TRANSFER WITH CORRELATED NOISE AND MEMORY EFFECTS IN QUANTUM COMMUNICATION TECHNOLOGIES

**Abstract:** Nowadays, Information and Communication Technologies (ICT) play increasing central role in the socio-economic, scientific and technological development of our information society. Recently, the peculiar features exhibited by matter at the microscopic (quantum) level, reached by continuous miniaturization, have delivered very interesting advances in many ICT areas, i.e. quantum information science. At this level noise plays an important role, although so far scientists have mainly investigate the impact of uncorrelated noise on quantum ICT (QICT), i.e. noise sources not exhibiting correlations in space and in time. However, investigating the latter will become increasingly pressing with the continuing miniaturization of information processing devices and with higher and higher transmission rates over quantum channels. Here, we will investigate and characterize in a universal framework correlated noise and memory effects in QICTs,

which will have a significant impact to realistic optical and solid-state implementations. Particularly, we will deepen a new many-body approach to memory channels (Plenio and Virmani, 2007) and generalize it to bosonic channels, e.g. optical fibers used in long-distance secure quantum communication. Finally, we will propose experimental tests of the expected results, opening up new horizons for realistic QICTs, i.e. fast communications and nanotech processors. This highly original and innovative proposal has the advantage of uniting quantum information theory and condensed matter physics, two very fruitful branches of physics, in which European scientists both on the theoretical as well as on the experimental side are renowned worldwide with Imperial College being a centre of excellence. Under the tutoring of a leading expert in the field (Prof. M. Plenio), it will help the fellow, Dr. F. Caruso, whose previous expertise makes him well-suited for this project, to become a fully independent researcher aspiring to leading academic positions.

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**NBR: 235092** **ACRONYM: SPICIX** **EC FUND: 176803**

**DG:** REA **Call: FP7-PEOPLE-IEF-2008** **Thema:** FP7-PEOPLE-IEF-2008

**Title:** Single nano-Particle Imaging with Coherent Intense soft X-rays

**Abstract:** Ultrafast coherent diffraction using soft and hard X-rays is actually revolutionizing imaging science thanks to new sources recently available. This powerful technique extends standard X-ray diffraction towards imaging of non-crystalline objects and leads actually to a strong impact in physics, chemistry and biology [Miao, Nature 1999]. New ultrashort pulses recently available hold the promise of watching matter evolving with unprecedented time and space resolution. With the SPICIX project we propose to use table-top x-ray coherent source to perform ultrafast nanoscale imaging. X-ray generation from High Harmonic Generation (HHG) in gases are inexpensive compared to free electron lasers (FELs) and provides the capability for the generation of intense femtosecond and attosecond coherent X-rays. To perform the research, a new infrastructure dedicated to ultrafast imaging has been implemented in CEA Saclay. We will increase available X-ray intensities by one orders of magnitude and have single shot imaging available. The unique properties of the HHG sources will open new and complementary (with respect to FELs) fields of science. Using coherent X-ray diffraction (CXD), we will be able to 'get rid of the crystal' in diffraction experiments, and obtain images with few tens of nanometers in resolution of non-repetitive single nano-particles in single shot. We will then explore the limits of the coherent imaging technique in time. The capability of following a system evolving in time is very challenging. Dynamics at a femtosecond time scale involving ultrafast properties of matter at a nanometer scale will be involved. This is beyond our current knowledge on ultrafast processes and is thus of high impact on a very broad area in science and industry.

**NBR: 235114** **ACRONYM: CLERMONT4** **EC FUND: 4278121**

**DG:** REA **Call: FP7-PEOPLE-ITN-2008** **Thema:** FP7-PEOPLE-ITN-2008

**Title:** Exciton-polaritons in microcavities: physics and devices

**Abstract:** The discovery of Bose-Einstein condensation (BEC) of exciton-polaritons in 2006 and the demonstration of room-temperature polariton lasing in 2007 have opened the way to realisation of a new generation of optoelectronic devices referred to as polariton devices. The research on exciton-polaritons and polaritonics allows the quantum effects of superfluidity, entanglement, squeezing of light to be brought to the everyday life and used in new light sources, optical switches, modulators and memory elements. The fundamental principles of polariton physics have been established by our previous networks "CLERMONT" and "CLERMONT2" within the 5th and 6th FP. The breakthrough achieved in 2006-2007 brings the polaritonics on a new level and makes its rapid development in Europe an overall strategic priority. Our present consortium composed by 10 European academic teams and supported by 6 leading industrial groups has a critical mass in polariton physics and technology. We intend to form a new generation of solid state physicists able to maintain the European leadership in this rapidly developing interdisciplinary research field. Four of the present partners took part in the discovery of the BEC of polaritons and polariton lasing, six others have given key contributions into polaritonics over the last decade. The Coordinator of the project holds the Marie Curie Chair of Excellence "Polariton Devices" at the university of Rome. We propose 16 full term PhD and 3 postdoc projects to be realized at two network nodes each with a compulsary training in industry. We shall organize the international conference on Optics of Excitons in Confined Systems in 2009, 3 international conferences on Physics of Light-Matter Coupling in Nanostructures and 2 Summer Schools on Nanophotonics. The project will form a world-leading international team of researchers capable to implement the ideas of polaritonics in a new generation of optoelectronic devices.

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**NBR: 235120** **ACRONYM: CD14** **EC FUND: 330100**

**DG:** REA **Call: FP7-PEOPLE-IOF-2008** **Thema:** FP7-PEOPLE-IOF-2008

**Title:** Innate and adaptive immune responses to nanocell-based tumor-targeted cancer therapeutics

**Abstract:** According to the project ‘Fighting against cancer today’ (FACT, funded by the EU 2008), molecularly targeted drugs with associated sophisticated diagnostic systems to personalize care are likely to have a great impact on cancer control in Europe. At the

same time, drug delivery is going to be progressed by nanomedicines that can ferry high amounts of active drugs to the tumor. A recent achievement in developing drug delivery systems are bacterially-derived mini- or nanocells that appear to be superior to other nanovector systems, e.g. in terms of stability or packaging versatility, and that aim reaching high therapeutic efficacy with low to no toxicity. This drug-delivery system has been developed by EnGeneIC Pty Ltd in Sydney, Australia. A critical issue of the application of bacterially-derived nanocells to human beings is their inherent capability to provoke adverse immune responses, i.e. via the LPS receptor CD14. Cellular responses to this vector, to be determined as changes in the composition or the activity status of subsets of peripheral blood cells, will be addressed by this proposal. Parallel investigations will yield clues on whether individual genetic variations in molecules determining LPS sensitivity do affect safety and/or efficacy of the delivery system. Moreover, individual genetic variations in drug metabolizing molecules as well as tumor genetics will be assessed in view of therapy outcome predictivity. Research and evaluation of applicability to patients in Europe will be continued at the return host institution, the University Medical Center in Göttingen, which cares for about 13.700 cancer cases yearly, which has a strong focus on molecular tumor diagnostics and individualized medicine within the Department of Gastroenterology, and which provides expertise by experienced specialists as do the German Primate Center or the Max Planck Institutes. Collaborations are strongly envisaged to transfer knowledge most efficiently.

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**NBR: 235272** **ACRONYM: ELSI** **EC FUND: 246983**

**DG:** REA **Call: FP7-PEOPLE-IEF-2008** **Thema:** FP7-PEOPLE-IEF-2008

**Title:** Electrochemical Silicon Layers Formation in Fused Salts

**Abstract:** The goal of this project is to create new electrochemical methods of silicon layer formation in fused salt electrolytes in the range of thicknesses from nanometres to micrometres. The research aims to achieve results of high technological significance – formation of silicon thin films for photovoltaic applications (e.g. solar cells). The advantages of the proposed electrochemical SiO2 deoxidation include: 1) possibility to use electrons as absolutely clean agents instead of toxic volatile chemicals used in classical processes; 2) energy efficiency; 3) spatial control of the silicon formation from pinpoint to complete layer, which will open new possibilities for microelectromechanical systems and silicon chip technologies; 4) control of the composition, morphology, structure and crystallinity of the layers depending on the operating conditions. Socio-economic reasons of the project stem from the imperative to search for effective substitutes of fossil energy. Solar energy can be converted to electricity with no impact on the environment and the fuel is free. However, so far, solar energy is expensive. The major part of its costs is related to materials, mainly silicon, which is the most widely used material for manufacture of solar elements. The classical processes of silicon production are highly energy consuming, low efficiency and unfriendly to the

environment. The project proposes a new advantageous methods, which offer an opportunity to avoid the drawbacks of classical processes. The research results will be important to major European solar electricity programmes.

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**NBR: 235286** **ACRONYM: NANOSOL** **EC FUND: 161899**

**DG:** REA **Call: FP7-PEOPLE-IEF-2008** **Thema:** FP7-PEOPLE-IEF-2008

**Title:** From Femto- to Millisecond and From Ensemble to Single Molecule Photobehavior of Some Nanoconfined Organic Dyes for Solar Cells Improvement

**Abstract:** In this project (NANOSOL), we wish to study the femtosecond to millisecond dynamics of some selected triphenylamine dyes in solutions and confined within MCM-41 mesoporous silica material in absence and in presence of TiO2. The dyes are being proposed as potential candidates for solar energy conversion with an efficiency in classical configuration up to 5.33%. We will interrogate their relaxation dynamics and study the effect of zeolites nanoconfinement on the related and subsequent elementary events from fs to ms regime. Powerful techniques based on ultrafast-laser and single-molecule technologies will be our tools to follow the electronic flow from its birth triggered by a photonic excitation of the dye to its death due a charge recombination. We will then explore for the selected dyes the relationship between the time domain and nature of the zeolites (space domain, nano to micrometer domain).This relationship will be examined at a single molecule and particle level with both time and spectral resolutions. The results will be correlated to their solar-energy conversion efficiency in a classical scheme, and will serve for designing confined systems for a new generation of photovoltaics cells. We believe that the expected results will be of great interest to the scientific community working in nanotechnology (nanoLED's, nanostwitches, etc) nanomedicine (drug delivery), and environmental science (clean energy), and in particular to those performing dye-sensitized solar cells.

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**NBR: 235323** **ACRONYM: PHOTONANOFLUIDIX** **EC FUND: 250701**

**DG:** REA **Call: FP7-PEOPLE-IEF-2008** **Thema:** PEOPLE-2007-2-1.IEF

**Title:** Self-assembly of confined colloidal objects for the study of nano-optic phenomena

**Abstract:** We have demonstrated the presence of attractive interactions arising in low ionic strength solution between charged soft-matter objects and highly curved regions of like-charged confining surfaces. These unexpected interactions result in stretching of DNA and trapping of colloidal particles in solution in a nanofluidic slit. This proposal seeks to further understand the attractive interactions arising between colloidal objects and like-

charged confining walls in low-ionic-strength solution, in order to better control the underlying self-assembly process. The controlled self-assembly of arrays or arbitrary arrangements of discrete charged metal or dielectric nano-objects will permit the investigation of plasmonic and photonic phenomena in two dimensions, e.g., plasmonic coupling of resonantly excited metal nanoparticles, modification of fluorescence emission of single emitters diffusing in solution very close to discrete metal nano-objects, realization of novel ordered and disordered arrangements of nano-objects (e.g. dielectric particles like TiO2) for studying light scattering phenomena in two dimensions. One of the chief advantages of the self-assembly technique described here over conventional fabrication techniques is that the substrate surface structure which directs self-assembly of the optically active element acts as a “rewritable surface” enabling the investigation of the plasmonic and photonic properties of ensembles of particles of similar surface charge but variable dielectric properties.

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**NBR: 235394** **ACRONYM: SPINMANYBODYSEMINANO** **EC FUND: 222124**

**DG:** REA **Call: FP7-PEOPLE-IIF-2008** **Thema:** FP7-PEOPLE-IIF-2008

**Title:** Spin and Many-Body Interaction Phenomena in Semiconductor Nanostructures

**Abstract:** We propose systematic extensive investigations of many-body spin phenomena in semiconductor nanostructures, with a goal to find effective magnetic/spin mechanisms to tailor various electronic anisotropies, potentially useful in device structures. The two principal Bychkov-Rashba (BR) and Dresselhaus (D) spin-orbit interactions (SOI) will be explored. We plan to calculate the anisotropy of the Friedel oscillations and of the many-body renormalization of the electron mass. We propose to design a device scheme to control the effective mass through the relative strength of the BR and D couplings. We’ll study the effect of exchange and correlations on the SOI induced anisotropy of plasmons. Another goal is to investigate the SOI effects on the charge and spin Coulomb drag (CCD and SCD). We'll focus on two effects, related to (i) the new drag channel, induced by the inter-chirality transitions, and (ii) the dominance of large-angle-scattering events in CCD and SCD. This requires accurate calculations with the use of the exact Lindhard polarization function. Recently we have shown that SCD is suppressed in wide quantum wells. Here we propose to study a crossover from Coulomb to phonon-mediated spin drag with an increase of the carrier density and the well width. Another goal, related to the phonon system, is the calculation of spectral and damping properties of new complexes, coupled plasmon-optical phonon modes, in the presence of BR+D SOI. Next we propose to study spin phenomena in hybrid ferromagnetic-semiconductor nanostructures. We will focus on the SOI induced modifications of the magnetic edge states (the snake and cycloid orbits of electron spin) and on the induction and manipulation of spin currents along magnetic interfaces. Finally, we’ll study side jump SOI as a mechanism to induce Spin Hall Drag in bilayers, coupled via Coulomb

interaction. We put forward a method to probe electron spins in spatially separated layers with many-body interaction, and vice versa.

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**NBR: 235414** **ACRONYM: IPHON** **EC FUND: 127912**

**DG:** REA **Call: FP7-PEOPLE-IEF-2008** **Thema:** FP7-PEOPLE-IEF-2008

**Title:** Imaging Photochemistry in Nanoparticles

**Abstract:** We propose Fellowship dealing with the photochemistry of free nanoparticles. More specifically, we concentrate on molecules embedded in the cluster environments. One example are systems of atmospheric relevance - attaching hydrogen halides, NOx or HNO3 on water clusters can mimic chemistry on the polar stratospheric clouds. As the second example the hydration of biomolecules can provide a bridge between behavior of isolated molecules and more complex biological systems. The Fellow will work with a unique cluster beam apparatus. At an early stage of the fellowship he will extend the apparatus with the ion slicing detection system, which presents the latest development in the field of ion imaging and will provide a substantial increase in sensitivity. When the detection system is designed, build and tested, we propose series of photolysis experiments. They will concern three classes of systems - heterogeneous nanoparticles of atmospheric and biological relevance and organic molecules embedded in rare gas clusters, where the photolysis should lead to synthesis of novel rare gas molecules. Simultaneously with the experiments, the Fellow will participate on the calculations to support interpretation of data in the collaboration with the quantum chemistry group in Prague.

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**NBR: 235482** **ACRONYM: SUPERANTIBODIES** **EC FUND: 171300**

**DG:** REA **Call: FP7-PEOPLE-IEF-2008** **Thema:** FP7-PEOPLE-IEF-2008

**Title:** Synthetic Superantibodies â€“ Bioinspired Engineering of Artificial Receptor Structures

**Abstract:** The project “Superantibodies” encompasses an interdisciplinary approach to accomplish the first instance of a biohybrid, yet fully synthetic three dimensional recognition element by converging the benefits of natural biorecognition with those of a synthetic approach. The bio-inspired concept is modelled on the antibody binding site whose binding capacity is the result of a defined three-dimensional structure in which loops of polypeptides cooperatively interact with the antigen through specific biomolecular interactions. The project implements a combination of modern biomolecular and bioanalytical techniques to identify peptides within these structures that are pivotal for the interaction with the antigen, and to use organic chemistry to synthetically mimic

these peptides whilst maintaining their biological function. Affinity driven self-assembly between these peptides and their specific antigen is used to produce templates for a subsequent molecular imprinting process, resulting in a site-specific integration of peptides into the structural backbone of a molecularly imprinted polymer. It is hypothesised that it will be possible to rationally engineer recognition elements with tailored affinities by changing the number and the type of the embedded peptides to rationally create structures whose affinity can outperform that of naturally derived antibodies. This proposal is built on the expertises and scientific strengths of Dr Heiko Andresen while taking him in new directions. The multidisciplinary group of Dr Molly Stevens provides a fertile environment for the scientific and professional development of the applicant, and Imperial's infrastructures and dedication to high-quality professional and personal career development strongly support Dr Andresen in reaching a position of professional maturity. The project proposal is in line with aims and policy objectives of the FP7, with particular high relevance for the theme-crossing FP7 initiative 'NanoMedicine'.

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**NBR: 235486** **ACRONYM: SCQSR** **EC FUND: 227984**

**DG:** REA **Call: FP7-PEOPLE-IEF-2008** **Thema:** FP7-PEOPLE-IEF-2008

**Title:** Superconductivity in quantum-size regime

**Abstract:** Recent technological advances resulted in high-quality superconducting metallic nanofilms and nanowires being in the clean limit for the confined motion of electrons. Potential application of such nanostructures stimulated active research of their physical properties. These properties are mainly governed by the size-quantization of the transverse electron spectrum. This effect has a substantial impact on the basic superconducting characteristics, e.g., the order parameter, the critical temperature, the critical magnetic field and the critical current. This project focuses on theoretical description of various superconducting properties of nanostructures in the clean regime. The theoretical tools to perform this involve the formalism of numerical self-consistent Bogoliubov-de Gennes equations, the Eliashberg equations approach, Richardson exact solution of the discrete BCS model and the functional integration method. The study intends to clarify important question concerning the enhancement of the superconductivity due to quantum confinement and ways to optimize the targeted properties of superconducting structures. The results are expected to be of interest to a broad community of physicists working in the field of superconductivity as well as to technologies designing novel applications based on superconducting nanostructures.

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**NBR: 235515** **ACRONYM: SAWQUBIT** **EC FUND: 171867**

**DG:** REA **Call: FP7-PEOPLE-IEF-2008** **Thema:** FP7-PEOPLE-IEF-2008

**Title:** SAW-driven single-electron quantum devices with optical readout of the spin

**Abstract:** The proposal is aimed at the experimental development of a novel solid-state quantum computation scheme and its interface to quantum optics. The computation scheme, put forward at the University of Cambridge, uses the spin of an electron trapped in the dynamic potential associated with a surface acoustic wave (SAW) as a "flying" qubit. The capture of single electrons in moving quantum dots occurs when the SAW passes along a depleted 1D channel. Channels in parallel provide the set of qubits, forming the core of a SAW-based quantum processor. The objective of this proposal is the development of such SAW-driven single-electron quantum devices and the optical readout of the spin of the electron to extend the capabilities of the quantum processor into the optical domain for quantum communication. A lateral n-p junction will be introduced into a GaAs heterostructure, where each electron recombines, leading to single-photon emission. The measurement of the polarization of the emitted photon will determine the spin of the electron, since the conservation of the angular momentum dictates that the photon will have left or right circular polarization depending on the sign of the component of the electron's spin in the direction of propagation of the photon. Therefore, the flying-qubit processing scheme may permit the distribution of quantum information quickly over large distances across the quantum circuit, to interface with quantum memory registers at fixed localizations or static qubits, and to transfer a qubit from an electron in a quantum dot to a polarized photon. In addition, the fact that the flux directly measures the average spin alleviates the need for single-shot spin or photon measurements and greatly improves the signal-noise ratio. The cutting-edge research of this proposal will permit the fellow to acquire a strong hands-on experience on the most advanced techniques of nanoelectronics, which will have an enormous impact on his career development.

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**NBR: 235596** **ACRONYM: HHG-NANOTOMOGRAPHY** **EC FUND: 324540**

**DG:** REA **Call: FP7-PEOPLE-IOF-2008** **Thema:** FP7-PEOPLE-IOF-2008

**Title:** High-Harmonic tomography and characterization of Nano-structures

**Abstract:** Progress in nanoscience and nanotechnology depends not only on examining the surfaces of nanostructures but on looking deep inside to identify what electronic, magnetic, optical, and chemical processes are of importance. For characterizing internal variations in shape, organization, or chemical composition over distances of hundred of nanometers, usage of XUV and soft X-ray electromagnetic radiation not only complements electron microscopy but also offers important advantages. Unfortunately the relevant sources in this spectral region (Synchrotrons and Free Electron Lasers) are extremely large, prohibitedly expensive, and not accessible to most of the scientific

community. We propose to use XUV and soft X-rays produced by High Harmonic Generation (HHG), as the source for exploring most advanced multidimensional (3D spatial+1D frequency+1D time) imaging modalities for nanostructures and nanomaterials, and studying their fundamental physical properties and dynamics. Specifically, we propose to research the combination of multicolor nano-tomography and optical coherence tomography with high harmonic generated light, making particular emphasis on three-dimensional volumetric structural and property analysis. We will also use the HHG to study fundamental optical properties of nano-materials in XUV and soft X-ray region of spectrum - very important and largely unexplored area so far. We believe that such an interdisciplinary approach (attoscience techniques applied into nanoscience) can result in qualitatively new advances in the field.

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**NBR: 235649** **ACRONYM: VIRUS ENTRY** **EC FUND: 3844983**

**DG:** REA **Call: FP7-PEOPLE-ITN-2008** **Thema:** FP7-PEOPLE-ITN-2008

**Title:** Molecular Mechanisms of Cell Entry of Enveloped Viruses

**Abstract:** Virus infections are a major cause of diseases and death among men and animals. The recent outbreak of SARS and the danger that an avian influenza virus may become pandemic, have clearly shown that members of any virus family can potentially turn into a pathogen. To combat virus infection and propagation, systematic and comprehensive studies both on viral components mediating virus-cell interactions, and on the cell biology behind virus entry are necessary. Our network, teaming academic and industrial groups, is aimed at undertaking an interdisciplinary effort to reveal the diversity of pathways and associated molecular mechanisms of cell entry of enveloped viruses. Research by experimental and theoretical approaches will be directed towards the identification of cellular receptors and of viral fusion proteins responsible for interaction with host cells. Among topics are folding, three-dimensional structure and conformational changes of viral fusion proteins as well as virus triggered signalling cascades in cells. Biophysical approaches will unravel the relationship between energetics of conformational changes of viral proteins and membrane bending and fusion. Together with industrial partners the project will identify potential targets for designed drug development, and will develop virus protein coated nanoparticles as new biotechnological and medical tools. The groups have complementary expertise at the highest standard in all required techniques of virology, molecular and cellular biology, biochemistry, proteomics, structural biology, theoretical and experimental biophysics. A challenging research and training environment in an international setting will provide young scientists with a network wide research-oriented training devoted to the specific aspects of virus entry and to structuring of industry projects and commercial exploitation of results, and a local training in soft skills and basic complementary education adapted to the personal needs.

**NBR: 235655** **ACRONYM: COMPNANOALD** **EC FUND: 184759**

**DG:** REA **Call: FP7-PEOPLE-IEF-2008** **Thema:** FP7-PEOPLE-IEF-2008

**Title:** Preparing Complex Nanostructures by Atomic Layer Deposition

**Abstract:** During the fellowship, novel, beyond the-state-of-the-art complex nanostructures will be prepared by atomic layer deposition (ALD). ALD is based on successive, alternating surface controlled reactions from the gas phase to produce thin films in the nanometer range with perfect conformality, process controllability and precise control of film thickness. In this project, four complex nanocomposites and nanoreplicas will be prepared: (1) Semiconductor oxide core-shell structures (WO3 nanotube core with TiO2 oute shell) will be prepared for photocatalysis. It will be investigated, how the photocatalytic activity can be tuned by the thickness of the outer TiO2 layer. (2) Carbon nanotube (CNT) – multilayer semiconductor oxide (SnO2, In2O3, TiO2) core-shell structures will be prepaped for selective gas sensing at room temperature. The effect of composition and thickness of semiconductor oxide outer shells on gas sensing will be explored. (3) 2D and 3D Al2O3 nanotubes will be prepared by using a template with 2D and 3D nanoholes. After removing the template, the 2D and 3D nanotubes will be set free. (4) The TiO2replica of biological structures (lotus leaf) with a complex nanostructured surface will be prepared. The hydropobic and photocatalytic features of the as-produced multifunctional material will be tuned by its thickness. The new nanomaterials and new preparation approaches have a high potential to lead to new products and technologies. The training objective of the fellowship is to provide the fellow the neccessary skills to start a new ALD research group. A thourough theoretical and practical training on ALD will be obtained (planning and conducting ALD experiments, analytical tools for characterizing ALD films, listening to courses on ALD and nanotechnology). Supplementary skills will be also provided (managing an ALD laboratory, conference organizing, supervising BSc and MSc students, oral and written presentation, knowledge of Finnish language).

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**NBR: 235673** **ACRONYM: MAGBIOMAT** **EC FUND: 165444**

**DG:** REA **Call: FP7-PEOPLE-IEF-2008** **Thema:** FP7-PEOPLE-IEF-2008

**Title:** Study of magnetic responsive biopolymer based materials

**Abstract:** The aim of the proposed project is to synthesize and characterize new nanostructured magneto-responsive biopolymer-based materials by the introduction of functionalized magnetic nanoparticles in biogel and foam to gain a deeper understanding of two

fundamental aspects: - The understanding of the formation mechanisms of such structures: magneto-responsive networks. - The correlation between the behaviour of the nanostructured composite biopolymer-based materials under the change of external conditions, such as magnetic field, shear, ionic strength, pH and composition of polymer and magnetic nanoparticles or the chemical structure of the constituents. The research project will involve different aspects. On one hand, it will include the elaboration of new magnetic-responsive biopolymer-based materials. On the other hand, the project will try to develop specific dedicated apparatus, allowing the measurements of mechanical properties under magnetic field to determine structure and dynamical properties at different external conditions as well as kinetics of structure transformation of such systems controlled by magnetic field. The combination of synthesis, characterization and theory will allow a synergy for the elaboration and optimization of novel magnetic-responsive biopolymer based materials with fine tuned properties and for their future application in industry (vehicle for drug delivery, intelligent materials for medical and structural applications).

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**NBR: 235721** **ACRONYM: HIGH-VOLTAGE PV** **EC FUND: 183052**

**DG:** REA **Call: FP7-PEOPLE-IEF-2008** **Thema:** FP7-PEOPLE-IEF-2008

**Title:** New materials for high voltage solar cells used as building blocks for third generation photovoltaics

**Abstract:** Global warming caused by the combustion of fossil energy carriers is the biggest environmental threat for the 21st century, which has boosted the demand for “clean energy”. Scientific breakthroughs are needed in the photovoltaic (PV) sector to reduce the price of PV-generated electricity and thus to become compatible with conventional power plants. This can only be achieved with new type of solar cells comprising of novel materials which are cheaper than current silicon technology and which allow large scale production at low cost. Nano-structured solar cells such as the dye-sensitized (DSSC), quantum dot sensitized or polymer based solar cells are promising candidates. Until now improvement of such cells aims mostly towards the modification of one component within existing cell architectures (for example the investigation of several dyes in DSSCs, while the electron and hole conducting media remain unchanged). It is the intention of the proposed research to investigate materials which have not been attracted considerable attention for photovoltaic applications as well as materials which are already widely used. In a first step we aim to screen materials for solar cells which are based on a large bandgap window layer and a absorber with a bandgap between 1.4 – 2.8 eV. This requires the preparation of a large number of devices and the acquisition and analysis of huge amount of data. We intend to adopt techniques commonly used in pharmacy and biology, where large amounts of samples are screened and analyzed. In the second phase the photovoltage limitations are investigated and the voltage will be

maximized. In the final phase interface geometry will be changed to increae the photocurrent.

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**NBR: 235722** **ACRONYM: NANOLANTA** **EC FUND: 169851**

**DG:** REA **Call: FP7-PEOPLE-IEF-2008** **Thema:** FP7-PEOPLE-IEF-2008

**Title:** Nanoengineering of functional lanthanide tetrapyrrole systems

**Abstract:** The paradigm of the project is to develop a whole set of novel 2D and 3D nanostructures of next generation organic materials (lanthanide porphyroids) on metallic surfaces. This experience will help the researcher to become a principal investigator in the near future. The organic nanostructures will be created in ultra high vacuum conditions by molecular beam organic deposition on metallic monocrystalline substrates. The samples will be geometrically characterized by low temperature STM; electrically by STS, XPS, UPS and NEXAFS; and magnetically by XMCD and Kerr at ultra low temperature. The complexity of the project means a quite interdisplinary work both scientifically and technically. A close collaboration is expected among experimental physicists, experimental chemists and theoretical physicists (ab initio and DFT). We will use two porphyroids: phthalocyanines and porphyrins, because of their remarkable temperature stability, photoelectric properties and versatility. These are aromatic macrocycle molecules with a empty cavity in their centre. The idea is first to grow one monolayer film of porphyroid and then filled the cavities by a subsequent deposition of a lanthanide material, creating a single decker. This nanostructure will be used as a template where to study the coordination properties of the huge lanthanide atom. One set of experiments will be related to catalytic properties towards the adsorption of oxygen and carbon dioxide. A second step of experiments would imply the deposition of a porphyroid on top of the lanthanide porphyroid film with the objective of creating a double decker nanostructures (porphyroid/lanthanide/porphyroid). The proximity of the two rings make them promising as basic units for: molecular semiconductors; optical gas sensors (including artificial noses), electrochemical sensors and mass sensors; organic field-effect transistors; and single molecular magnets. These applications are priorities of the European Technology Platforms.

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**NBR: 235806** **ACRONYM: MEMBRANE NANOTUBES** **EC FUND: 91809**

**DG:** REA **Call: FP7-PEOPLE-IEF-2008** **Thema:** FP7-PEOPLE-IEF-2008

**Title:** Determining the molecular basis for the formation of membrane nanotubes between immune cells

**Abstract:** Recently, membrane nanotubes have been found to connect many types of cells, including cells of the immune system. These nanotubes contain actin filaments, are not attached to substrate, and are distinct from other cell tethers such as filopodia and membrane bridges. Potentially, specific coupling of cells over long distances can have great significance, and evidence is mounting to suggest that membrane nanotubes may have a role, e.g., in specific cell-to-cell signalling and trafficking of pathogens between cells. However, the molecular basis for the nanotubes formation is almost completely unknown. This is an urgent goal for research in this area since functional tests for the importance of membrane nanotubes are currently hampered by a lack of knowledge regarding specific ways to inhibit or augment nanotube formation. Thus, I aim to address this issue by answering three specific questions: 1) Does the formation of membrane nanotubes and filopodia require the same proteins? This will be assessed by knocking-down the production of proteins involved in filopodia formation, and observing the frequency of nanotube formation, their length, and their stability. In parallel I will test for the presence of these proteins in membrane nanotubes using mAb and/or fluorescent protein-tagged proteins as available. 2) Next I will test whether proteins known to be involved in the morphological changes the underlie immune cell spreading and contraction are required for the formation of the nanotubes. The effects of these proteins will be tested by knocking-down proteins and additionally, changes in cytoskeletal and membrane tension that are coupled to changes in cytoskeleton reorganization will be evaluated using optical tweezers. 3) Finally, I will test if the membrane protein and lipid composition in nanotubes is different from that in the rest of the cell surface membrane. If a specific composition is revealed, this may imply specific functions for the nanotube membrane.

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**NBR: 235873** **ACRONYM: NANOBUBBLES** **EC FUND: 160595**

**DG:** REA **Call: FP7-PEOPLE-IEF-2008** **Thema:** FP7-PEOPLE-IEF-2008

**Title:** Investigating surface nanobubbles

**Abstract:** Surface nanobubbles are gaseous bubbles on liquid-immersed substrates. They are typically 10nm high and 100nm across and, according to classical physics, should dissolve in microseconds but are found to persist for days. Nanobubbles are thought to be responsible for slip in micro and nanofluidic devices, as well as bearing relevance to several macroscopic fluid-solid interactions, including boiling and colloidal destabilisation. Nanobubbles are a very new research area and are ripe for investigation. The following questions will be answered during this fellowship: Is there an 'ideal recipe' for nanobubble creation? Can the size difference between 'known' micro- and 'unknown' nanobubbles be bridged? What is the mechanism that sustains nanobubbles? How does the presence of nanobubbles affect slip? These questions will be answered using a mixture of several techniques: Electrolysis for nanobubble creation; atomic force microscopy for manipulation and

visualisation; and ultra-high-speed video imaging for visualising larger bubbles and bubble arrays. The Host institute is currently joint-leading the field in nanobubble research with institutions in China and Australia. This proposal will set Europe apart from the rest of the world as the number one research centre of excellence in nanobubble research.

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**NBR: 235874** **ACRONYM: IPHASEFLOW** **EC FUND: 230288**

**DG:** REA **Call: FP7-PEOPLE-IEF-2008** **Thema:** FP7-PEOPLE-IEF-2008

**Title:** The new technology of intermetallic phases treatment by fluid flow in Al-Si casting alloys.

**Abstract:** Aluminum-silicon base alloys are widely used in castings (foundry industry) due to their excellent castability and high strength-to-weight ratio. In the Al-Si alloys, the presence of small amounts of Fe and Mn brings about a complicated microstructure due to the formation of a rich variety of intermetallic phases (IMPs) during solidification, which generally have a negative effect on the mechanical and physical properties of a as cast part. The main goal of the project “iPhaseFlow” is to prepare new technology of intermetallic phases treatment by fluid flow in Al-Si casting alloys. The project investigates problems of artificial fluid flow influence on the growth, morphology and spatial arrangement of intermetallic phases in as-cast AlSi-base alloys containing especially Fe and Mn as alloying elements. The “iPhaseFlow” studies concerns detailed tasks: directional solidification of casting specimens in Artemis aerogel furnace by the presence of fluid flow and without it (in different solidification conditions), detailed analysis of the microstructure of the Al-Si alloys (dendritic pattern geometry, length and thickness of the IMPs, localization of the IMPs, their density and shape distribution), numerical modeling for physical understanding of the mechanisms leading to the anticipated changes in microstructure by the presence of IMPs and fluid flows. Project involves trainings in using advanced world wide unique facilities and modern scientific methods: directional solidification within Artemis, microstructure investigation by methods SEM/EBSD/EDX, x-Ray nano-tomography, x-Ray diffractrometry, metallography, quantitative image analysis (AnalySIS, Origin, IDL) and thermal analysis DTA, DSC. “iPhaseFlow” will be conducted in Institute of Materials Physics in Space MP of the German Aerospace Center DLR in Cologne.

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**NBR: 235879** **ACRONYM: RHIZO** **EC FUND: 218119**

**DG:** REA **Call: FP7-PEOPLE-IEF-2008** **Thema:** FP7-PEOPLE-IEF-2008

**Title:** Rhizospheric biofilms at root-microbe-mineral interfaces: A key to improve productivity, sustainability and CO2 balance in forests

**Abstract:** In the past decades, forest productivity was maximized by the use of large quantities of fertilizers and pesticides. These chemicals are produced by complex processes, which consume high levels of energy from fossil fuels and emit large amounts of CO2. The secondary effects of the chemicals include increased ground and surface water pollution and soil degradation in all forested ecosystems in Europe and other parts of the world. Part of the problem is a lack of fundamental understanding about mineral-derived nutrient dynamics in forests, their weathering release, storage and transport in soils and roots to maintain high, but sustainable, production of high quality wood products. If practices could be developed to enhance natural processes for nutrient acquisition and transport, pesticide and fertilizer use could be reduced, energy could be saved, CO2 emission decreased, and environmental sustainability insured. Root-microbe-mineral interactions in the rhizosphere regulate mineral-derived nutrient acquisition and transport to plant roots. I will investigate these interactions to improve understanding of rhizospheric biofilms formed in symbiotic associations. My research sofar shows that these biofilms enhance silicates mineral weathering, sequester atmospheric CO2 in the hydrosphere, and decrease the loss of mineral-derived nutrients to ground and surface water. To expand on this, I will examine the chemical and physical structure of the root-microbe-mineral interface, using stat-of-the-art nano-scale techniques combined with microbiological and biogeochemical approaches under natural and controlled growth conditions. I will also characterize the biofilms under elevated CO2 levels. The science and technology results gained from this project will contribute directly the the scientific community and to the society through improvements in commercial tree production, forest health and sustainability under the increased CO2 levels.

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**NBR: 235886** **ACRONYM: ADHCEM** **EC FUND: 181350**

**DG:** REA **Call: FP7-PEOPLE-IIF-2008** **Thema:** FP7-PEOPLE-IIF-2008

**Title:** ADHESION AS A TOOL FOR IN-BUILT NANOTECHNOLOGY IN CEMENT-BASED MATERIALS

**Abstract:** The global cement industry produces 2.8 billion tones of product plus 1bn tones of CO2 and is increasing at 5% per annum, especially in developing nations. This is one of the largest CO2 producing industries which needs to improve the efficiency of its product to reduce global impact. Yet the understanding of the fundamental binding forces in cement is not clear. This project aims to study the nano-scale forces operating between the cement gel particles in order to produce more effective cement products, provided there is much of interest in linking phenomena occurring at the nano-scale with engineering performance at the macro-scale. The fellow's expertise on the forces involved between nanoparticles with structured water on their surface will give an important insight in how to use the adhesive potential of water in cement-based

materials. This should allow the designing of suitable cementitious microstructures containing nanometric particles, at present a very difficult task. Indeed, this is the first time that these interdisciplinary ideas of adhesion by confined water will be systematically explored in cement-based materials, including those used as biomaterials. To do so, this project will bring together the interdisciplinary concepts and techniques from nanoscience with examples from bioadhesion to define radical changes and applications. Ultimately, this project is timely and relevant because the European leading companies (cement-based service providers or manufacturers – four out of the world top five cement producers are European) are being pushed to offer sustainable materials as well as best mechanically tailored ones. The scientific benefit will be defined by the high quality papers submitted to leading academic adhesion and nanoscience journals. In turn, societal benefit will be gained by exporting the results to emerging countries where the economic development model needs urgently to respect the sustainability.

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**NBR: 235914** **ACRONYM: SAHNMAT** **EC FUND: 160028**

**DG:** REA **Call: FP7-PEOPLE-IEF-2008** **Thema:** FP7-PEOPLE-IEF-2008

**Title:** Self-assembly of Helical Functional Nanomaterials

**Abstract:** The construction of nanostructured objects of well-defined size is of outmost importance for nanotechnology to surmount claims for potential applications and exploit improved chemical, physical or biological properties of a functional nanofeatured material. Biomedical imaging is one particular field of interest for water-compatible chemical self-assembly of nanosized objects. The outlined project aims to develop a methodology for the preparation of nanostructured objects in aqueous media with the emphasis lying on the precise control over the size, shape and degree of functionalisation of the features. The goal is to build upon supramolecular helical scaffolds for the development of self-assembled functional structures in the nanoscopic range, which are to be used in magnetic resonance imaging (MRI) applications. MRI has made a significant impact to the area of diagnostic medicine, predominantly due to advances in the development of contrast agents (e.g. paramagnetic Gd(III)-complexes). We believe that a supramolecular approach based on self-assembled Gd(III) chelating molecular units can combine the benefits from both low and high molecular weight derivatives: high contrast agent efficiency or contrast enhancement on one hand, and an improved control over the pharmacokinetics on the other hand, because of the non-covalent dynamic nature that holds the objects together. Furthermore, challenges in the field of MRI contrast agents will be met by the development of multivalent target-specific structures. Advantages include the accumulation of MRI signals in a region of interest, and the combination of 1H MRI contrast enhancement with a second imaging label. 19F MRI is a highly promising probe because of the high sensitivity of the 19F nuclide and the absence of any background interference in living systems.

**NBR: 235967** **ACRONYM: OPTSUFET** **EC FUND: 164877**

**DG:** REA **Call: FP7-PEOPLE-IEF-2008** **Thema:** FP7-PEOPLE-IEF-2008

**Title:** Optically tuneable supramolecular field-effect transistors

**Abstract:** OPTSUFET aims at enabling cross-disciplinary training and research at the interface between Supramolecular Chemistry, Materials-/Nano-Science, Physics and Electrical Engineering. The overall goal of OPTSUFET is to generate new scientific and technological knowledge by combining supramolecularly engineered nanostructured materials (SENMs), mostly based on organic semiconductors, with tailor-made interfaces incorporating photochemically switchable self-assembled monolayers on substrates and electrodes, for fabricating prototypes of optically tuneable two- (supramolecular wires) and three-terminal devices (field-effect transistors). The training and research objectives of OPTSUFET are: 1. Surface texturing with photoswitchable SAMs: derivatization of electrically conductive/insulating solid substrates and metallic nanostructures with azobenzene SAMs to optically modulate the charge injection at the metal-SENM and dielectric-SENM interface. By controlling the interface chemistry it will allow the tuning of the self-assembly of electroactive molecules at surfaces into pre-programmed supramolecular assemblies. 2. Hierarchical self-organization on textured surface of multifunctional SENMs based on electrically active functionalized carbon-based 1D and 2D nano-objects such as n- and p-type rod-like and discotics (oligo-thiophenes, perylenediimides, hexabenzocoronenes, etc) at surfaces on the functionalized substrates. 3. Nanochemistry and nanoprobes: Scanning probes (AFM, STM, KPFM, C-AFM) quantitative time and space resolved characterization of various physico chemical properties of SENMs, in particular correlation between structural and electronic properties. 4. Fabrication of photoswitchable supramolecular wires and transistors: Measurement of charge mobility, under photochemical modulation, in SENMs two- and three-terminal devices varying systematically the wire's (1) chemical composition, (2) conformation, (3) length and (4) doping.

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**NBR: 236009** **ACRONYM: EQESD** **EC FUND: 160595**

**DG:** REA **Call: FP7-PEOPLE-IEF-2008** **Thema:** FP7-PEOPLE-IEF-2008

**Title:** Exploring Quantum Entanglement using Spins in Diamond

**Abstract:** We propose to create and detect quantum entanglement between a single spin in the solid state and a single photon and in a second step entanglement between two distant spins. This experiment will be realized using Nitrogen-Vacancy (NV) centers in diamond,

that are exceptionally well suited for this due to their very long spin coherence time and a strong and stable optical transition that allows spin-photon mapping. An NV center in a superposition of spin states will be optically excited, and the subsequently spontaneously emitted photon will have a frequency that is entangled with the NV center's spin. This entanglement will be detected using correlation measurements, and thus requires high-fidelity coherent control and readout of single spins. Entanglement of distant spins will be realized via interference of indistinguishable photons originating from two distant NV centers. Successful generation of long-distance entanglement constitutes a milestone challenge for quantum information processing in the solid state. The proposed experiment combines state-of-the art methods from quantum optics, magnetic resonance and nanofabrication and provides an excellent opportunity for the researcher to deepen and diversify his experimental skills. This training will allow the researcher to reach professional maturity and carry out an independent line of research.

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**NBR: 236031** **ACRONYM: NANOMULTIMOLSWITCH** **EC FUND: 168279**

**DG:** REA **Call: FP7-PEOPLE-IEF-2008** **Thema:** FP7-PEOPLE-IEF-2008

**Title:** REDOX AND CONDUCTING ROUTING IN MOLECULAR ELECTRONICS. NANOSCALE ARCHITECTURES AND NOVEL PHENOMENA

**Abstract:** Recent developments in molecular electronics and nanotechnology, in general, offer the promise of devices, of great relevance to information technologies, with unprecedented capabilities including memory devices with extraordinary storage capacity as well as circuit elements of vanishing size and superlative speed. Some of the molecular entities that have shown particular promise, to date, include donor/acceptor (D/A) assemblies, transition metal complexes and others. Of particular importance has been our ability to encode information and/or achieve electronic functionality by the storage or movement of charges. This proposal addresses two separate projects which are part of general investigations of nanoscale materials chemistry. The first project will focus on the development of molecular architectures at the nano-scale level toward molecular electronics applications. Molecular switching systems will be investigated and their capability to act as molecular wire allowing the electrons flow through the conjugated system will be tested. Upon establishment of their photoelectrochromic properties, binuclear metallic complexes will be synthesized to study of intramolecular electron transfer through mixed-valence species. By precisely modulating the spacing in between the redox units, we will investigate, with unprecedented control, self-exchange rates in redox reactions, the distance dependence of electron transfer, and photoinduced electron transfer. Subsequently, we will proceed to immobilize the binuclear compounds connected through the corresponding switch on gold or platinum surfaces by taking the advantage of the ability of thiol or nitrile functional groups to bind properly on such surfaces. We thus propose a seed project where we will explore the two areas described

above and assess their potential utility as a means of reversibly and reproducibly making contact to nanostructures, for information encoding and as conduction modulators.

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**NBR: 236091** **ACRONYM: SURFOIDS** **EC FUND: 168279**

**DG:** REA **Call: FP7-PEOPLE-IEF-2008** **Thema:** FP7-PEOPLE-IEF-2008

**Title:** Organization and self assembly of colloidal particles trapped on a Isotropic-Fluid/Liquid-Crystal Interface: Effects of particle anisotropy and interface curvature

**Abstract:** The ability to control regular spatial arrangements of particles is one of the central issues of the ‘‘bottom-up’’ approach to nanotechnology. Self-assembling of colloidal particles has arisen as a very hopeful alternative. However, these studies are typically performed in aqueous media where the interparticle interactions are poorly controlled. In this project we will study the interactions between particles trapped in a novel challenging interface consisting of a nematic liquid crystal and an isotropic fluid. Our fist objective is to exploit the unique properties of the nematic phase to achieve a high degree of control in the interaction of the particles trapped in the interface. In this geometry, the particle-particle interactions are triggered by capillary forces resulting from the interface distortion. We will employ electric/magnetic fields as well as sophisticated anchoring conditions for the nematic to tailor these distortions in terms of range, amplitude, and directionality. We will address questions concerning crystallization, melting and aggregation in a 2-dimensional space. To quantify the interface deformations we will use a technique based on Michelson interferometry and optical tweezers. Our second objective is to study the effect of particle anisotropy in the formation of ordered patterns. We will consider both spherical particles with anchoring gradients and particles with exotic geometry. Despite the richness of behavior expected, the relationship between the anisotropy of colloids and their collective behavior when trapped in an interface is still largely unknown. Finally, we will analyze how the behavior of the colloidal particles is affected by the interface curvature. Some elegant theoretical predictions show that equilibrium positions are located in the points of constant Gaussian curvature. This behavior is still completely unexplored experimentally and may find practical relevance in pickering emulsions, solid stabilized foams, etc.

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**NBR: 236250** **ACRONYM: DIB SCREENING** **EC FUND: 180783**

**DG:** REA **Call: FP7-PEOPLE-IEF-2008** **Thema:** FP7-PEOPLE-IEF-2008

**Title:** Rapid functional characterization of ion channels with droplet interface bilayers

**Abstract:** Of the estimated 400 ion channels encoded in the human genome, ~70 are potassium (K+) channels. Their implication in a number of human diseases, e.g., cardiac arrhythmia, cystic fibrosis, makes K+ channels relevant drug targets. Whereas the number of high-resolution structures of membrane proteins has consistently increased over the last few years, their functional characterization using screening approaches has not kept pace with that of water-soluble proteins. In this context, reliable and informative rapid screening assays for membrane proteins are needed. By further developing the recently reported droplet interface bilayer (DIB) system, I intend to develop a rapid automatable platform for screening wild-type channels as well as libraries of mutant ion channels using Kcv (viral), KvAP (prokaryotic) and Kv1.2 (eukaryotic) as model systems. My blueprint for such a screening device is analogous to an assembly line consisting of a network of microchannels to; (i) construct lipid monolayer-encased aqueous droplets, (ii) synthesize ion channels inside these nanobioreactors by coupled in vitro transcription-translation (IVTT), (iii) form bilayers with other droplets containing channel blockers, (iv) subsequently measure single-channel conductance to determine activity. The assay will be capable of screening one channel against hundreds of blockers or screen a library of mutants against one or a few blockers. The development of this nanoscale-streamlined process offers the possibility of producing powerful lab-on-chip instruments for membrane protein assays, which have previously proven intractable.

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**NBR: 236252** **ACRONYM: MRI_NANOBIOSENSOR** **EC FUND: 237283**

**DG:** REA **Call: FP7-PEOPLE-IOF-2008** **Thema:** FP7-PEOPLE-IOF-2008

**Title:** Novel Nanobiosensors for Identifying Microorganisms Using Magnetic Relaxation Switches

**Abstract:** The goal of this proposal is the development of a totally new type of reagent/instrumentation system based on a Nanobiosensor that Prof. Josephson and Prof. Weissleder have developed and termed “magnetic relaxation switches” (MRS). We propose to apply MRS for two different objectives: 1) detection of microorganisms through their specific sequences on their rRNA (outgoing phase); 2) identification of specific tumoral cells lines using MRS functionalized with specific lectins (return phase).

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**NBR: 236281** **ACRONYM: DCN** **EC FUND: 169992**

**DG:** REA **Call: FP7-PEOPLE-IIF-2008** **Thema:** FP7-PEOPLE-IIF-2008

**Title:** Dynamic Combinatorial Nanoparticles for Protein Surface Recognition

**Abstract:** Recent developments in genomics and proteomics have generated an urgent need for new methods of interrogating and targeting biochemical networks. In particular new means of interfering with protein-protein interactions are in high demand and of considerable therapeutic potential. New materials are needed that can recognise and bind to specific protein surfaces. We aim to develop a new approach to the recognition of proteins using individual nanoparticles and dynamic networks of nanoparticles. This requires the development of: 1. Functional nanoparticles capable of selectively recognising proteins. We will explore the potential of dynamic combinatorial chemistry to direct the functionalisation of the surface of the nanoparticles. 2. A means of translating nanoparticle-protein interactions into a signal. Our approach is to use nanoparticle networks that respond to the presence of proteins with a redistribution of their surface functionalisation, which, in turn, produces an optical readout through fluorescence resonance energy transfer. The project is critically dependent on the host's expertise on dynamic combinatorial chemistry and the applicant's expertise on the characterisation of nanostructures. The expected outcome is a conceptually new means of interfacing functional nanoparticles with biomolecules, based on an innovative molecular network approach. This systems chemistry strategy breaks with the reductionist tradition that has characterised most research in chemistry for the last centuries.

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**NBR: 236322** **ACRONYM: GASNOW** **EC FUND: 210933**

**DG:** REA **Call: FP7-PEOPLE-IEF-2008** **Thema:** FP7-PEOPLE-IEF-2008

**Title:** Gas Sensor NanoWires by Chemical Vapour Deposition

**Abstract:** This proposal has two main aims: to perform high quality scientific and technological research, and to give training to an experienced researcher to establish her as an independent researcher. Scientific goals Fabrication of nanostructured WO3 as Gas Sensor material using Chemical Vapour Deposition WO3 is one of the most used materials for gas sensing, due to its sensitivity and stability. However, it does not show a very good selectivity, and the fabrication process is often long and expensive. This project investigates the improvement of the selectivity and sensitivity of WO3 by depositing it as nanowires. To perform this, the use of a hybrid (combined) Atmospheric Pressure and Aerosol Assisted Chemical Vapour Deposition (AP/AACVD) is proposed; this technique is very cheap, simple and could be easily industrialised. The modification of WO3 will be also investigated: noble metal nanoparticles (i.e. Au, Ag, Pt) and Carbon NanoTubes (CNT) will be used to modify the gas sensor surface. In this way the selectivity of the sensor is greatly improved. The main scientific/technological outcome of the project will be the fabrication of prototype gas sensor devices, achieved by performing the deposition on appropriate gas sensors substrates, such as alumina and micro-hot-plate. Training goals The training given to the researcher will consist of both scientific and transferable skills. Scientifically, she will gain knowledge in Materials

Science (experience in gas sensors materials) and Electric Engineering (instruments and devices). The latter one is particularly important for her, considering her Chemistry/Materials Science background – she will broaden her skills and expertise. Regarding transferable skills, she will be mentored by the scientist in charge in tasks such as research proposal writing, student supervision, and project management and coordination. All these activities will help her to improve her profile and establish her as an independent researcher.

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**NBR: 236628** **ACRONYM: ILISENSE** **EC FUND: 209799**

**DG:** REA **Call: FP7-PEOPLE-IEF-2008** **Thema:** FP7-PEOPLE-IEF-2008

**Title:** Ionic Liquids and Carbon Nanotubes for Sensors and Separations

**Abstract:** This project aims at exploring novel materials and their composites for significantly enhancing the performance of dedicated gas sensors as well as separation barriers. The focus will be on two emerging materials, namely carbon nanotubes and room-temperature ionic liquids, as well as composites consisting of both, with the aim of creating highly versatile and flexible affinity interfaces that exhibit drastically improved physico-chemical properties compared to conventional materials. During this truly multidisciplinary project, these materials and their composites are to be explored on one hand in combination with advanced gas sensor systems, in order to determine both the potential, possible windows of operation as well as the respective limitations. On the other hand, it is deliberately envisaged to study these materials and the respective composites for application in an apparently diverse area, namely gas/vapour separation barriers. The underlying aim of this approach is that both successful gas sensing and gas/vapour separation require high selectivities to target solutes, and transport phenomena naturally occurring in the latter can be a limiting factor in the former, although often neglected. This project will therefore exploit the application of carbon nanotubes and room-temperature ionic liquids, as well as their composites, in a strongly transdisciplinary manner in order to foster knowledge transfer between two of the priority areas of the NMP-programme for the benefit of significant advances in both.

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**NBR: 236665** **ACRONYM: DASZIF** **EC FUND: 172434**

**DG:** REA **Call: FP7-PEOPLE-IEF-2008** **Thema:** FP7-PEOPLE-IEF-2008

**Title:** Rational Design and Synthesis of Zeolitic Imidazolate Frameworks (ZIFs): an experimental and statistical approach

**Abstract:** One of the novel and most promising alternatives to combine the advantages of microporous zeolites and metal organic frameworks (i.e., high porosity, framework diversity, transition metal centers and tailored linkers) resides in the nanoporous imidazole-based MOFs: zeolitic imidazole frameworks (ZIFs). ZIFs comprise a network of corner units (transition metals) and linker units (imidazole molecules which can be further functionalised) that allow a manifold of frameworks due to their structural analogy to zeolites). ZIFs offer many interesting and promising features compared with other porous materials, such as the possibility to tailor these materials for specific applications; different framework zeolite structures, with different cavities and windows; and exceptional chemical stability in refluxing organic solvents, water, and aqueous alkaline solution, compared with other MOFs. Yet to date, the discovery of promising novel porous materials for specific adsorption applications is happening by trial and error rather than by rational design. In this way, molecular simulations provide an outstanding tool to predict the performance of the materials and, like so, to select the optimal structures for a given application. This project will address three objectives: i) identify optimal ZIFs structures through the simulation of its adsorption performance, ii) the synthesis and characterisation of pre-selected ZIFs using different computational and experimental techniques, iii) the assessment of their performance for industrial applications by simulations and experiments. More specifically, the target applications are: a) gas separation of CO2/CH4 and xylenes mixtures as well as gas purification; b) storage of CH4 and H2; c) capture of CO2. The novelty of this work lies in the synergetic combination of tools from different areas and disciplines to produce advances that are of both fundamental scientific interest and of engineering relevance in industrial applications

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**NBR: 236667** **ACRONYM: HYGENMEMS** **EC FUND: 231422**

**DG:** REA **Call: FP7-PEOPLE-IEF-2008** **Thema:** FP7-PEOPLE-IEF-2008

**Title:** Chip Integrated Hydrogen Generation-Storage-Power Micro System

**Abstract:** The primary objective of the proposal is the development of a chip integrated hydrogen generator based on polymer electrolyte membrane water electrolysis with on-board hydrogen storage and an option for a bi-functional operation (as a unitized regenerative microfuel cell). The output of the generated hydrogen should be high enough to feed up to 50 mW.cm-2 microfuel cell at continuous operation, while enabling hydrogen storage capable to compete the conventional secondary batteries. The goal will be achieved by application of novel cost efficient nanostructured materials with enhanced catalytic activity and long durability, innovative technology for membrane electrode assembling based on microsystem processes, and precisely controlled reactant supply. The possibility for reverse operation of the system (as microfuel cell) will be addressed through deposition of composite bifunctional catalytic films and corresponding design modifications, including incorporation of hydrogen storage in the developed MEMS. The

long term goal is the realisation of an integrated hydrogen generation–storage–power micro system for autonomous energy supply of wireless electronic devices. The host organisation (HO) has a high competence and internationally recognised achievements in the field of microsystem technology, proven by development and fabrication of variety of sensors, microfluidic, and medical devices. The researcher (R) is an experienced scientist with expertise in electrochemical material testing, electro catalysis, and hydrogen energy conversion. The competence of HO and R complement one another in an ideal way, building a strong basis for successful realisation of the project goals. The researcher will have excellent opportunity to acquire new theoretical knowledge and practical skills in the field of microsystem technology. These will promote the Researcher's future career and help her to establish a Microelectroichemistry Laboratory in Bulgaria.

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**NBR: 236797** **ACRONYM: DAPOMAN** **EC FUND: 164473**

**DG:** REA **Call: FP7-PEOPLE-IIF-2008** **Thema:** FP7-PEOPLE-IIF-2008

**Title:** Directed Assembly of Polymeric Materials Nanofabrication

**Abstract:** Block copolymer materials have been shown to self-assemble into a variety of morphologies, some which exhibit complex and intricate nanometer scale structures. That attribute has led researchers to propose material and device fabrication strategies. The majority of synthetic, characterization, and theoretical work on block copolymers has focused on their bulk behavior. A smaller effort has focused on the study of multiblock copolymers, their mixtures with homopolymers and nanoparticles under confinement. Complex morphologies have been elucidated with the help of theoretical models and theoretically predicted phase diagrams have often provided much needed roadmaps for experimentalists. Available theoretical and computational approaches face considerable challenges when trying to describe large 3-dimensional multiblock copolymer samples, nanoparticle-copolymer composites, confined copolymers and composites and the effects of fluctuations on such systems. The central idea of our proposed work is to direct the assembly of thin copolymer films by creating nanoscale patterns on substrates that the polymer can recognize. Past work has shown that it is possible to achieve perfect, defect-free registration between block-copolymer morphology and a nanoscale surface pattern over macroscopic length scales. The goal is to use directed assembly as a platform on which to improve a molecular-level understanding of block copolymers and copolymer nanocomposites through the systematic application of external, molecular-level constraints that induce well defined responses. The applied, technological goal is to create a multi-scale theoretical and computational formalism that will facilitate study of confined block copolymer-based systems, and guide development of efficient nanofabrication strategies for large-scale production of materials and devices such as those already encountered in the

semiconductor industry or those encountered in the photovoltaic and energy storage industries

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**NBR: 236811** **ACRONYM: ET DPHEN DNA** **EC FUND: 181935**

**DG:** REA **Call: FP7-PEOPLE-IIF-2008** **Thema:** FP7-PEOPLE-IIF-2008

**Title:** Electron transfer through multiple consecutive phenanthrenyl containing DNA

**Abstract:** Synthesis and development of novel DNA base pairs that are orthogonal in their recognition properties compared to the natural base pairs are avidly pursued by scientists. Such novel base pairs are investigated as tools in biotechnology and in designing novel genetic systems. Interest in artificial base pairs continues because of their application in materials research and nanosciences. Likewise charge transfer (CT) through the DNA duplex has received considerable attention and is being explored in fundamental and applied research. The objective of this project is to synthesize and study DNA containing more than one phenanthrenyl-pair (dPhen-R) in a duplex DNA. This would provide the first example of electron transfer through a duplex containing multiple phenanthrenyl (dPhen-R) base replacements. Substitutions (R) on the ring will influence the redox potential of the aromatic system. This will also influence the electron transfer efficiency. This project will also pursue the synthesis of a base-pairing nucleobase analogue capable of acting as an electron acceptor. This electron acceptor will report on electron transfer by a fluorescent response and increase the stability of the duplex. The optimized DNA-based architecture will then be attached to a gold surface in order to observe direct electron transfer by nanoelectrochemistry. It is envisioned that this novel DNA architecture and future designs may be applied in DNA based biosensors and in the area of DNA nanomaterials.

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**NBR: 236885** **ACRONYM: FUNSENS** **EC FUND: 171867**

**DG:** REA **Call: FP7-PEOPLE-IEF-2008** **Thema:** FP7-PEOPLE-IEF-2008

**Title:** Functionalised Carbon Nanotube Electrochemical Sensors

**Abstract:** This proposal is for a highly promising young scientist from Spain, Aleix Garcia-Güell, to carry out research and high level training in electrochemical nanoscience, in the renowned Electrochemistry and Interfaces Group at the University of Warwick (UK). The project will greatly enhance the expertise of Garcia-Güell in nanostructured materials, and applications thereof, and take him in significant new directions in the area of single-walled carbon nanotube (SWNT) materials. Specifically, the project will consider novel ideas for a new generation of electrochemical and electrical sensors based on SWNTs

and will allow Garcia-Güell to become expert in state-of-the-art nanoscience techniques. The Host Group has recently established that SWNT random networks have very interesting electrochemical properties, including a step change in detection sensitivity, and it is now opportune to build significantly on this work to: (i) develop a detailed understanding of the electrochemistry and conductance of SWNTs at the nanoscale; and (ii) optimise the use of SWNT network and array devices for high sensitivity detection in solution, including bioanalysis. Surface functionalisation will be key part of the programme and Garcia-Güell will bring to bear his expertise, developed in Barcelona and through collaborations in the USA and Germany, on functionalisation strategies using metal nanoparticles and bilayer membranes. The programme is an excellent match of complementary skills of the Fellowship candidate and Host Group and will yield new scientific breakthroughs which will have substantial benefits to European science in this important area. The Fellow will have the opportunity to develop complementary skills essential for career development, through training programmes at the University of Warwick. He will benefit considerably from the extensive network of collaborators of the supervisors and their experience in mentoring young researchers.

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**NBR: 237059** **ACRONYM: EMC IN APT** **EC FUND: 184752**

**DG:** REA **Call: FP7-PEOPLE-IEF-2008** **Thema:** FP7-PEOPLE-IEF-2008

**Title:** Towards the analysis of energy conversion materials at the atomic scale

**Abstract:** The properties of interest of functional materials are strongly correlated to their intimate structure down to the nanometre scale. Designing novel, more efficient materials requires a control over their structure and chemistry at the very same scale. One of the challenges of the 21st century is to tailor energy conversion materials enabling a more efficient harvesting of the energy of the Sun. Thermoelectric power generation is a well-known effect through which thermal energy (heat) is directly converted into electricity without any intermediate working fluid or any moving parts. These materials are generally highly doped, nanostructured materials. Although very promising, the structure – activity relationship in this class of materials is still really unclear, due to a lack of nano-scale characterisation. I aim here to get trained on several analytical techniques, including dual beam Scanning Electron Microscope/Focused-Ion-Beam, Atom Probe Tomography (APT), and various declinations of Transmission Electron Microscopy. I will also acquire a better understanding on the functioning of the laser-assisted APT, which will enable me to start a collaborative work to correct the intrinsic aberrations of the technique. Drawing on the experience of the host group in conducting a complete materials science study, I will improve my skills in this field, and acquire methods, protocols and knowledge enabling me to solve materials science problems. This training will permit to perform at the same time an in-depth study of the multi-scale characterisation of the structure and chemistry of these materials, aiming to improve the design and efficiency of thermoelectric devices.

**NBR: 237110** **ACRONYM: THERMOSOMENANOREACT** **EC FUND: 184203**

**DG:** REA **Call: FP7-PEOPLE-IEF-2008** **Thema:** FP7-PEOPLE-IEF-2008

**Title:** Nanoreactors for controlled radical polymerizations based on the thermosome from Thermoplasma acidophilum: Templating synthesis of polymer nanoparticles and in-situ regeneration of the template

**Abstract:** Polymer nanoparticles have found applications in high performance materials and in medical applications. An attractive route to these particles is the use of templates. However, templating methods have the disadvantage that one templating entity is needed for every object that is formed. The ideal template for polymerizations would therefore be a nanoreactor that regenerates itself once the nanoparticle is formed. Nature provides us with a protein assembly that, when further modified, may fulfill this requirement. The thermosome from Thermoplasma acidophilum is a protein complex which encloses two central cavities with a void volume of 130 nm3. Each cavity is accessible via several small pores and one large pore. The large pore is gated by a build-in lid, whose opening and closing can be controlled by ATP. I propose to use the thermosome as a nanoreactor for Atom Transfer Radical Polymerization (ATRP). To this end, an appropriate catalyst will be covalently linked into the cavity of the protein complex. In the thermosome's closed conformation, monomers, crosslinkers and initiators can enter the cavity through the small pores, and a polymer particle will form inside of the protein. The cavity of the thermosome acts as template in order to generate nanoparticles of defined size and shape. By opening the lid, the particles will then be released into the surrounding media and the nanoreactor regenerated for further reaction cycles. The objective is to run the process in a continuous way, so that the production of the nanoparticles becomes catalytic. To this end, the formation of the particles will be synchronized with the opening-and-closing cycle of the thermosome. Furthermore, the effect of the confined reaction space provided by the cavity will be exploited to achieve an enhanced control over the ATRP reaction in order to synthesize polymers of narrow molecular weight distribution with significantly less copper-based catalyst than normally needed for aqueous ATRP.

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**NBR: 237128** **ACRONYM: LIFELOOP** **EC FUND: 171466**

**DG:** REA **Call: FP7-PEOPLE-IEF-2008** **Thema:** FP7-PEOPLE-IEF-2008

**Title:** Microfabricated Silicon Oxygen Sensor and Reusable Nano Technology Based Carbon Dioxide Filter for Life Supporting Closed Loop Respiratory Equipment

**Abstract:** In a rebreather system exhaled breathing gas is collected in a counterlung and can be inhaled again after a recycling process, where CO2 is removed and metabolised O2 is replaced. Rebreathers are used by rescue services (fire fighters, smoke divers, miners), in medicine (anaesthesiology, O2 rebreathers for emergency treatments) and in diving. The ability of a closed circuit rebreather to provide a life sustaining gas depends on the correct function of each component. The main bottlenecks in present rebreather units are O2 sensing (electrochemical sensors) and the chemical CO2 removal. The scientific objectives of this proposal address on the one hand the research and prototyping of a novel paramagnetic microfabricated silicon O2 sensor. On the other hand an innovative and reusable nano technology based CO2 filter (nano porous fibres, polymer nanofibres) will be developed. Based on these components a prototype of a rebreather unit will be designed and characterized. The proposed work will be carried out at Imego, Sweden. Arne Sieber will receive intensive training in the fields of: - silicon micofabrication, MEMS design, fabrication and characterization - nanotechnologies, especially application and treatment of nano propos hollow fibres/polymer nanofibres Furthermore it is envisaged that he will be able to enhance his management, leadership, teaching and presentation skills.

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**NBR: 237224** **ACRONYM: NANOPHOTOCHROME** **EC FUND: 218731**

**DG:** REA **Call: FP7-PEOPLE-IEF-2008** **Thema:** FP7-PEOPLE-IEF-2008

**Title:** Energy Conversion within the Hybrid Materials Engineered from the Nanocrystals Quantum Dots and Photochromic Membrane Proteins

**Abstract:** Most photosensitive integral membrane proteins (PIMP) are not able to deal with the excess energy of photons from UV to blue region and normally do not absorb them at all. If high-energy photons were absorbed, they might destroy the light-harvesting chromophores or even induce apoptotic-like cell death. Thus, the energy efficiency of green plants is less than 5% and the energy-producing PIMP bacteriorhodopsin (bR) not possessing specific light-harvesting system utilizes less than 0.5% of solar light. Nanotechnology opens the way to increase performances of biological functions. Summarizing the sources of energy losses provides an idea to optimization through the engineering of a built-on-the-membrane light-harvesting antenna from photoluminescent (PL) quantum dots (QDs) which might be able: (1) to harvest light from deep UV to blue region, (2) to convert this energy to photons that can be absorbed by bR or photosynthetic reaction centers (RC) and (3) to transfer this energy to PIMP's chromophores thus improving biological function. The QD is a unique nanomaterial able to absorb a lot of light from UV to visible region and to convert it in the photons of PL in a narrow spectral region determined by their size. NanoPhotoChrome will combine the nanotechnology and genetic engineering, where genetic engineering develops RC and bR variants with biological functions adapted to specific application and nanotechnology develops QDs specifically selected to be optically coupled with the PIMP chromophores

and with surfaces functionalized to form complexes with biomembranes or to be chemically tagged with desired amino acid residues of bR or RC. Such optical and spatial coupling will form efficient energy transfer donor (QD)/acceptor (PIMP chromophore) pairs. The PIMP-QDs nano-units operating in the FRET-regime will provide new hybrid materials with improved biological functions with the advantages of efficiency of light-controlled operation, stability and low cost production.

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**NBR: 237252** **ACRONYM: SPIN-OPTRONICS** **EC FUND: 3280068**

**DG:** REA **Call: FP7-PEOPLE-ITN-2008** **Thema:** FP7-PEOPLE-ITN-2008

**Title:** Spin effects for quantum optoelectronics

**Abstract:** We propose to join the forces of ten leading European teams in order to achieve a critical mass in the new research field of Spin-Optronics, a vast novel research area at the crossroads of fundamental physics of quantum-mechanical spin, optoelectronics and nanotechnology, and establish the European leadership in this area on a world-wide scale. All three main directions of the Network research activities – growth and technology, spectroscopy and theory - will be concentrated on novel spin and light polarisation effects in nanostructures, utilising confinement of not only charges and spins, but also photons. In this field, the information is ultimately carried out by the spin of photons, can be encoded in the confined spin state and manipulated on the nano-scale and redelivered in a form of polarised photons. The four main project objectives are : 1°) Coherence of individual spin, storage of quantum information. 2°) Semiconductor entangled light sources. 3°) Interaction of free and localised spins in diluted magnetic semiconductors and hybrid structures. 4°) Spinoptronic devices based on cavity exciton polaritons. We are going to deliver a top level international level multidisciplinary training to 13 early stage researchers and 5 experienced researchers, offering them, in particular, a vast program of multinational exchanges and secondments. We will organise 4 project meetings, 3 schools and one final conference widely open to the whole scientific community. We expect this collaboration to achieve a breakthrough in establishing the fundament for the creation of new quantum devices and to overcome the existing severe fragmentation of research and training in this strategically important area, which is the main goal of our project.

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**NBR: 237365** **ACRONYM: SPIM** **EC FUND: 181350**

**DG:** REA **Call: FP7-PEOPLE-IIF-2008** **Thema:** FP7-PEOPLE-IIF-2008

**Title:** Metallopolymers with Metal-Metal Bonds: The Synthesis, Characterization and Applications of Novel Molecular Wires

**Abstract:** In this project the synthesis of metal-metal bonded oligomeric or polymeric linear metal chain complexes from metal-metal bonded dimetallic units by various methods is proposed. Nanoscience applications of the newly synthesized materials, e.g. as molecular wires, will be investigated. The proposed research on Metallopolymers with Metal-Metal Bonds: The Synthesis, Characterization and Applications of Novel Molecular Wires is at the cutting edge of the advanced functional polymer field and is both highly interdisciplinary and multidisciplinary. The project involves synthetic inorganic and coordination chemistry, synthetic polymer chemistry and polymer materials science and nanoscience. The project described herein would thus have a substantial multidisciplinary impact that reaches beyond purely the chemical sciences into materials science and physics.

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**NBR: 237375** **ACRONYM: SEMISPINNANO** **EC FUND: 181350**

**DG:** REA **Call: FP7-PEOPLE-IEF-2008** **Thema:** FP7-PEOPLE-IEF-2008

**Title:** Semiconductor Spintronics: Spin Polarisation and Nanodevices

**Abstract:** The proposed research programme addresses important issues in the field of ferromagnetic semiconductor spintronics which are of fundamental and potential technological importance. At the core of the project are the objectives of measuring the carrier spin polarisation in ferromagnetic semiconductors (a key quantity for spintronics) and of producing nanoscale ferromagnetic semiconductor single electron transistors which promise new spintronic functionalities. The applicant and the host Semiconductor Spintronics Group are uniquely matched to make this timely and important project possible. The applicant is an expert in the field of superconductivity and its interplay with magnetism who has extensive experience of focused ion beam nano-patterning and Point Contact Andreev Reflection spectroscopy, which makes possible the measurement of spin polarisation. The host Semiconductor Spintronics Group are internationally-leading in the field of ferromagnetic semiconductor materials and device development. This research project is very complementary to, but clearly differentiated from, existing research projects at Nottingham. In essence the intention is for the applicant to apply her particular expertise and techniques to materials fabricated at Nottingham for the realisation of important advances in semiconductor spintronics, thus greatly benefiting applicant and host institution.

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**NBR: 237391** **ACRONYM: GAPJUNCTION STRENGTH** **EC FUND: 168279**

**DG:** REA **Call: FP7-PEOPLE-IEF-2008** **Thema:** FP7-PEOPLE-IEF-2008

**Title:** Biophysical determinants of the adhesion strength of gap junctions

**Abstract:** Gap junctions are intercellular channels present in almost all epithelia and in many other specialized tissues. The correct function and formation of gap junctions are involved in diseases such as hypertension, deafness or cataracts. Gap junctions are formed by pairs of hexameric half-channels called connexons, which coaxially dock to connect two adjacent cells, assuring communication, signalling and adhesion between cells. Junctional microdomains are known to be form by thousands of closely packed connexon pairs. Even if the function as intercellular channels of gap junctions is widely studied, the forces supported by connexon pairs and the biophysical mechanism of microdomain formation are still unknown. The overall goal of this project is to determine the biophysical mechanisms of the adhesion strength of gap junctions. The proposed research will make use of state of the art biochemistry methods to purify and reconstitute connexons from eye lens fiber cells into raw membranes extracts. These will be combined with high end biophysical tools, atomic force microscopy and biomembrane force probe, to directly measure the binding forces between connexon pairs and to determine the kinetics and biophysical mechanisms of the aggregation and assembly of gap junctions. The expected outcomes of the proposed research will provide the first direct measure, at single and multiple molecule levels, of the adhesion strength of gap junctions explaining its underlying biophysical mechanisms. The interest of the project covers disciplines such as biophysics, molecular biology and nanotechnology.

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**NBR: 237636** **ACRONYM: PLANT CELL WALL** **EC FUND: 171300**

**DG:** REA **Call: FP7-PEOPLE-IEF-2008** **Thema:** PEOPLE-2007-2-1.IEF

**Title:** Functional analysis of the sugar based signalling process coordinating plant cell wall, primary metabolism and photosynthesis

**Abstract:** Photosynthesis enables the plant to capture solar energy and to store it in form of sugars in the plant cell wall. Therefore plant cell walls are of particular interest in terms of optimization of energy biomass characteristics and yield. The so-called cell wall integrity mechanism monitors the state of the plant cell wall and initiates changes in its structure and composition to maintain the functional integrity. The proposed research focuses on the dissection of this mechanism by analysing the cross-talk between cell wall stress response and primary metabolism / photosynthesis. To investigate the role of sugars in the signal transduction of the cell wall stress response, I will establish the FRET-based nanosensor technique to visualise sugars in planta using Arabidopsis thaliana seedlings and determine changes in sugar concentrations in response to cellulose biosynthesis inhibition (CBI, caused by isoxaben). In addition, I will investigate the role of

a cell wall invertase (ATCWINV6) in sugar signalling processes during CBI. Therefore, a detailed phenotypic characterisation of mutant plants and functional analysis of the gene / protein will be performed. To determine the effects of cell wall stress on plant metabolism I will perform detailed metabolic profiling of wildtype Arabidopsis seedlings exposed to CBI in combination with expression profiling of photosynthesis and starch metabolism genes. Furthermore, selected mutants involved in the cell wall stress response will be analysed regarding changes in sugar concentrations and metabolic effects in response to CBI. The results of this project will contribute to the understanding of the cell wall integrity mechanism that can change / regulate the quality of biomass. By shining light on the regulatory connection between cellulose biosynthesis and metabolism / photosynthesis this project will help to develop novel strategies to improve biomass quantity.

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**NBR: 237646** **ACRONYM: DNP4NANOCARAC** **EC FUND: 176803**

**DG:** REA **Call: FP7-PEOPLE-IEF-2008** **Thema:** FP7-PEOPLE-IEF-2008

**Title:** Dynamic nuclear polarization - enhanced high resolution solid-state NMR spectroscopy for atomic 3D structure determination of functionalized nanotubes and other nano-sized objects

**Abstract:** This project aims at developing the instrumentation and methodology required to perform solid-state sub-nanometer scale structural studies by Nuclear Magnetic Resonance (NMR). In the last decades NMR has proven to be a priceless tool to probe structure and dynamics of systems as diverse as glasses, metal surfaces, polymers and proteins, etc. However, the low sensitivity of the technique currently limits its outreach in material science, chemistry and biology. In order to overcome this limitation, we plan to use a technique called Dynamic Nuclear polarization (DNP) which is able to hyperpolarize nuclear spins. The DNP phenomenon, discovered at low magnetic fields (< 0.3 T), is far from being new but its usage at high magnetic fields (5 to 20 T and more) constitutes an exciting ongoing challenge. Compared to traditional NMR where the signal originates from thermal polarization, DNP enables us to enhance the NMR signal to noise by 1 to 4 orders of magnitude (depending on the nuclei) by transferring the magnetization of unpaired electron spins (polarizing agents) to the surrounding nuclear spins. Utilizing emerging high frequency microwave technologies, optimized polarizing agents together with state of the high resolution solid-state NMR instrumentation and methods, we plan to develop original magnetic resonance experiments at high magnetic fields. This technique should allow bringing down the NMR detection threshold to micro/nano-molar concentration, studying larger molecular systems and performing multidimensional experiments orders of magnitude faster. The project will lead to numerous interdisciplinary applications to illustrate the potential of DNP-enhanced NMR to characterize new materials for the nanotechnologies (functionalized nanotubes, molecular wires, etc.), new polymers for energy (CNT embedded in polymers, etc.), and

to determine the 3D atomic solid-state structure of biomolecules (membrane proteins, paramagnetic proteins, etc.).

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**NBR: 237671** **ACRONYM: PNMI** **EC FUND: 231422**

**DG:** REA **Call: FP7-PEOPLE-IEF-2008** **Thema:** FP7-PEOPLE-IEF-2008

**Title:** From the Planetary to the Nanoscale: Magnetism at the Interface

**Abstract:** Magnetic anomalies from deep sources are commonly thought to be induced by the present Earth's field to magnetite bearing rocks. Such magnetism is limited by the Curie isotherm of magnetite related to the local thermal gradient. The proposed research challenges this picture and is important for understanding large scale crustal anomalies. Natural rhombohedral oxides of the Fe2O3-FeTiO3 solid solution series with fine-scale exsolution intergrowths can retain a strong and very stable magnetic remanence to higher temperatures than magnetite. Their remanence can be important in the magnetism of crust at depth which currently is intensely investigated by satellite surveys on Earth and on extraterrestrial bodies. Two challenges stand out for understanding magnetism at high pressure and temperature. First, stability of nanoscale mineral intergrowths should be explored in experimental runs, followed by close examination of results under room-temperature conditions by EMP and TEM. Second, the direct effect of pressure and temperature on magnetic properties of single phases, solid solutions, and intergrowths must be investigated. This requires direct observations at pressure and temperature. BGI has a phenomenal background in high-pressure experiments at crustal conditions. It also has excellent background and equipment for exploring materials before and after experiments using electron microprobe, X-ray diffraction and high-resolution TEM. A Mössbauer- spectroscopy system through a diamond-anvil cell at pressure and temperature will allow direct recording of magnetic transitions under deep crustal conditions. To come into conjunction with these special capabilities and these highly advanced scientists in complementary, but different fields of science, will provide a unique opportunity for my research and career to move ahead towards an understanding of magnetic behaviour of the deep crust. This will lead to more definitive results in interpretation of deep-seated anomalies.

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**NBR: 237695** **ACRONYM: BIOMAG** **EC FUND: 181350**

**DG:** REA **Call: FP7-PEOPLE-IEF-2008** **Thema:** FP7-PEOPLE-IEF-2008

**Title:** Magnetic Biomaterials: Magnetically Loaded Stem Cells as Diagnostic and Therapeutic Vectors for Lung Cancer

**Abstract:** Lung cancer is the most lethal cancer in the world today. There are limited options for clinicians when treating patients, with only 10-15% of lung cancer patients surviving their malignancy. Despite the introduction of new chemotherapies, lung cancer survival is unchanged from thirty years ago. New ways of treating this disease are needed. We hypothesise that modified mesenchymal stem cells (MSCs) may be used to deliver magnetic nanoparticles through their engraftment, killing both tumour epithelium and tumour vasculature, while preserving normal tissue. We propose to introduce bio-compatible tailored magnetic nanoparticles into the MSCs to enable localised cellular-level sensing and heating while retaining the full viability and functionality of the MSCs. We will examine the kinetics of MSC engraftment and compare histological samples to in vivo quantification of engraftment using contrast-enhanced small animal magnetic resonance imaging (MRI) based on sensing the MRI signal of the introduced nanoparticles. MSCs will subsequently be locally heated by applying a time-varying electromagnetic field to induce heating of the nanoparticles (a process similar in principle to that used in microwave ovens) and consequent tumour destruction. MSC delivered therapy is particularly attractive. MSCs are easy to culture, expand and genetically manipulate. They are immuno-privileged, and also home preferentially to tumour tissues allowing systemic delivery to widespread tumour and metastases. As such they offer a uniquely bio-compatible, patient-derived therapeutic solution to the life-threatening disease of lung cancer.

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**NBR: 237726** **ACRONYM: MAGNOSTICS** **EC FUND: 170418**

**DG:** REA **Call: FP7-PEOPLE-IIF-2008** **Thema:** FP7-PEOPLE-IIF-2008

**Title:** Development of Magnetic LbL Particles for Diagnostics

**Abstract:** The project at hand aims at the development of new improved magnetic nano particles for diagnostics. These magnetic nano particles will then be incorporated in layer-by-layer capsules, which allow for a better detection of tiny amounts of analyte material in blood, urine and other body fluids. This innovative technology will significantly improve the reliability of the analysis of small amounts of bioorganic material and thereby facilitate medical diagnosis. If nowadays samples have to be sent to diagnostic laboratories for analysis, with the new technology every practitioner will be able to conduct diagnostic tests himself. Surflay, the Berlin-based host company for this project, is specialised in layer-by-layer technology and its application in diagnostics. However the necessary knowledge about the preparation of magnetic nanoparticles is missing. Therefore, Surflay plans to host Dr. Huang from Sichuan University, China for two years. Dr. Huang has achieved unique results on the preparation of magnetic nanoparticles. This project is meant to be the foundation of a long-term cooperation between Sichuan University and Surflay as well as other European network partner of Surflay.

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**NBR: 237738** **ACRONYM: NUCARCHIV** **EC FUND: 152968**

**DG:** REA **Call: FP7-PEOPLE-IEF-2008** **Thema:** FP7-PEOPLE-IEF-2008

**Title:** Novel approaches based on bionanoscience to manipulate, study, visualize and dissociate the nucleocapsid complex of HIV

**Abstract:** The general framework of the project NUCARCHIV is to use the recent development of nano-biotechnology to manipulate and image sophisticated in vitro reconstituted protein-nucleic acids complexes. Our goal is to bring several important advances in our understanding of the inner nucleoprotein structure (the nucleocapsid) of the human immunodeficiency virus (HIV), the causative agent of AIDS. The nucleocapsid complex plays essential roles during HIV assembly and early infection, and its modifications severely impede viral replication. The highly conserved nucleocapsid protein p7NC, the main actor of this complex, is considered as a prime target for developing new compounds with antiviral properties. Studies of nucleocapsid self-assembly, architecture and behavior in the host's cytoplasm are essential prerequisites for a complete description of HIV infection, and for the development of new anti-AIDS chemotherapies or vaccine. We will study by dynamic molecular imaging using atomic force microscopy single nucleoprotein complexes assembled from their purified partners (protein and nucleic acids templates). We will probe how these complexes are topologically modulated by the presence of viral enzymatic activities. Our goal is to provide a movie in real time showing the molecular dynamics of these complexes from virus maturation up to the late steps of early infection. We also propose to study the effect of a new molecule specifically designed to irreversibly inhibit HIV nucleocasid, with a potent application in AIDS prevention as component of next-generation of microbicids.

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**NBR: 237849** **ACRONYM: CROSSDIFFUSIONROSSI** **EC FUND: 154013**

**DG:** REA **Call: FP7-PEOPLE-IOF-2008** **Thema:** FP7-PEOPLE-IOF-2008

**Title:** Cross-Diffusion and pattern formation in reaction diffusion systems

**Abstract:** We propose to study spatiotemporal patterns that occur in chemically reacting systems as a result of cross-diffusion, the phenomenon whereby gradients in the concentration of one species affect the diffusion of another species. Patterns that arise by this mechanism appear to constitute a new class of self-organized structures that lies between thermodynamically stable structures like micelles or membranes and patterns like Turing structures or standing waves that exist only far from equilibrium. Our initial theoretical studies indicate that patterns induced by cross-diffusion can arise in quite simple reactions without the need for an activator-inhibitor couple. The predicted characteristic sizes of these patterns - tens to hundreds of nanometers with diffusion-

controlled reactions - suggest their potential application in nanotechnology. We shall first reexamine patterns in such systems as the Belousov-Zhabotinsky reaction in AOT microemulsions and lipid membranes, the chlorite-iodide-malonic acid reaction and the ferrocyanide-iodate-sulfite reaction. Next, we shall apply numerical and analytic techniques to simple model systems with appropriate cross-diffusion coefficients to establish both the concentration dependence of cross-diffusion coefficients and the range of pattern formation to be expected. We will also make needed modifications to the Taylor dispersion method for measuring cross-diffusion coefficients in multi-component systems and apply this approach to systems containing both unreactive and reactive species. Combining the results obtained from these three approaches, we will carry out experiments to find novel patterns induced by cross-diffusion, i.e., we will tune cross-diffusion fluxes to generate patterns.

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**NBR: 237900** **ACRONYM: ICARUS** **EC FUND: 2803715**

**DG:** REA **Call: FP7-PEOPLE-ITN-2008** **Thema:** FP7-PEOPLE-ITN-2008

**Title:** Hybrid organic-inorganic nanostructures for photonics and optoelectronics.

**Abstract:** The proposed ITN will support close collaboration between 8 highly experienced and complementary European teams, who in all cases are working at the forefront of semiconductor science, photonics and materials technology. The real value that is offered by our collaboration will be realized by the generation of new, genuinely disruptive hybrid-semiconductor optoelectronic technologies. It will also train the next generation of scientists at the highest level, producing a skilled cadre of researchers who will contribute the Europe's competitiveness in emerging optoelectronic technologies. Our network has world-leading experience in the field of structure fabrication and material synthesis (both organic and inorganic), together with a strong focus in ultra-fast spectroscopy, nano-optics, photonics, non-linear optics and device engineering. We also have a significant experience in high-level theoretical analysis of the optical properties of organic and inorganic semiconductors, as well as experience in industrial research. The establishment of ICARUS will thus realize the creation of new hybrid systems, their characterization and their implementation in photonic and optoelectronic devices.

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**NBR: 237946** **ACRONYM: T3NET** **EC FUND: 2857635**

**DG:** REA **Call: FP7-PEOPLE-ITN-2008** **Thema:** FP7-PEOPLE-ITN-2008

**Title:** Tissue Transmigration Training Network

**Abstract:** Cardiovascular and cancer-related diseases are the leading causes of human mortality and disability. The underlying mechanisms originate from chronic interstitial cell activation leading to pathological tissue remodelling and malfunction of cells. These depend on three fundamental processes: cell adhesion, migration, and modulation/degradation of the extracellular matrix (ECM), which together determine tissue invasion and remodelling. The proposed ITN Tissue Transmigration Training Network (T3Net) is aimed at promoting excellence in training in these areas, with an emphasis on cutting-edge technologies and complementary skills training. T3Net is very timely and has a multidisciplinary training approach unavailable within a single country of the EU. T3Net will be crucial in bundling current and future European expertise and to thus consolidate the momentary European leadership in these emerging key areas of biomedical research. The academic and industrial partners will provide training in new areas of research including the cell structures mediating invasion such as podosomes and invadopodia, as well as the application of materials sciences, nanotechnology and state-of-the-art in vivo imaging. These techniques will be applied to study ECM-cell interactions, in models encompassing vascular remodelling, immunity, inflammation and bone physiology, as well as the pathophysiology of cancer invasion. T3Net trainees will thus be at the forefront of current research, with innovative, complementary expertise in ECM remodelling and tissue transmigration in physiology and pathology. They will also benefit from valuable complementary skills training including communication, entrepreneurship and intellectual property rights. The strength and appeal of the T3Net proposal thus lies in the unique prospect to establish a long-term European network based on a new cohort of young professionals with the potential to exploit their knowledge in academic, clinical or industrial settings.

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**NBR: 237962** **ACRONYM: CYCLON** **EC FUND: 2415547**

**DG:** REA **Call: FP7-PEOPLE-ITN-2008** **Thema:** FP7-PEOPLE-ITN-2008

**Title:** Novel multifunctional cyclodextrin-based nanocarriers for drug encapsulation and delivery as a strategy to overcome current therapeutic drawbacks.

**Abstract:** There is a high demand for the development of new drug delivery strategies to combat major diseases in our society, particularly cancer. Current treatments are based on high efficacy drugs, however their non-selective uptake by both normal and tumor cells as well as the development of multidrug resistance (MDR), constitute major hurdles. Resistance is also associated with the use of nucleoside analogues as anticancer drugs in vivo. Photodynamic therapy (PDT), aims at selectively killing neoplastic lesions by the combined action of a photosensitizer and visible light. Passive targeting, involving enhanced permeability and retention effect, allows the accumulation of drugs on tumor sites, and concomitant active targeting with suitable functionalities, constitute properties currently associated with polymeric delivery systems. Cyclodextrins (CDs) are biocompatible and biodegradable oligosaccharide nanocages, known to improve the

solubility, stability and bioavailability of drugs. Scattered literature reports incidents that CDs may constitute potential means to overcome certain forms of MDR, or to effectively deliver photosensitizing anticancer drugs preserving their photodynamic properties. This network, highly specialized in CD chemistry, photochemistry, in vitro drug evaluation and in vivo applications, proposes to synthesize diverse families of new CD derivatives to build a platform of CD-based drug delivery nanosystems with a variety of architectures. These new generation nanocarriers, encompassing many cavities in a nm-sized vehicle, will possess high drug loading capacity, improved permeability and retention effect, enhanced targeting and complete biocompatibility. Their mode of action will be assessed in vitro and in vivo. These goals will be achieved via a strong training program of ESRs and ERs in a highly collaborating, multidisciplinary and application oriented program, with full participation of an SME partner, a leader in CD applications.

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**NBR: 237997** **ACRONYM: SEACOAT** **EC FUND: 3281108**

**DG:** REA **Call: FP7-PEOPLE-ITN-2008** **Thema:** FP7-PEOPLE-ITN-2008

**Title:** Surface Engineering for Antifouling - Coordinated Advanced Training

**Abstract:** The main research goal of SEACOAT is to improve understanding of biointerfacial processes involved in the colonisation of surfaces by marine fouling organisms. Our vision is that this enhanced understanding will inform the future development of new, environmentally-benign materials and coatings for the practical control of marine biofouling. Our principal objective is to discover which nano- and micro-scale physico-chemical properties of surfaces influence the adhesion of fouling organisms, through the use of surface engineering technologies to fabricate coatings that vary systematically in relevant surface properties, and length scales. We will use advanced surface analytical methods to characterise test surfaces for relevant physico-chemical surface properties and how these change after immersion. Parallel adhesion bioassays using a range of representative marine organisms will test intrinsic antifouling properties of surfaces. The network is an interdisciplinary cooperative of chemists, physicists and marine biologists. Intersectoral aspects unite basic and applied scientists working in universities, a large company and an SME. The project's S&T objectives will be delivered through research in 4 main Work Packages: viz. WP1-Surface Engineering, WP2-Surface Analytics, WP3-Bioadhesion, WP4- Integration. Two additional Work Packages (WP5, WP6) will be concerned with the Dissemination of project results and the Management of the Network respectively. The aim of the Training Programme is to increase the knowledge base and experience of trainees in each of the Thematic Areas and to develop their transferable skills for future careers in industry or academia. Six training objectives will be delivered through a suite of 7 Core Skills Areas (Research Project, Advanced Training Courses, Project Conferences, International Winter Workshop, Career Development Plan, Generic Research Skills, Transferable Research Skills).

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**NBR: 238017** **ACRONYM: HARVEST** **EC FUND: 4683560**

**DG:** REA **Call: FP7-PEOPLE-ITN-2008** **Thema:** FP7-PEOPLE-ITN-2008

**Title:** Control of Light Use Efficiency in Plants and Algae - From Light to Harvest

**Abstract:** Photoprotection against excess absorbed light energy is an essential and universal attribute of oxygenic photosynthetic organisms. This requirement has been a strong force in the evolution of plants and micro-organisms, and a diverse range of solutions have arisen. It has determined survival, productivity and habitat preference, and it determines the ceiling on the efficiency of energy conversion in photosynthesis in natural environment. Its investigation also provides insights into unique nanoscale switching processes. Understanding the molecular mechanisms of biological light adaptation will therefore have implication for many aspects of life, such as agriculture and food security, biodiversity and global climate change, biosolar energy and biofuels. This network brings together major high-quality EU centres with expertise in a wide range of disciplines – from plant physiology to molecular biology, structural biology and photophysics – and with great interest in interdisciplinary collaborative research. The network will thus provide a unique training opportunity for young researchers in key aspects of molecular biosciences and biophysical sciences in the context of practical applications in instrument development, agronomy, ecology and biotechnology. Researchers from within and outside this network will receive key research skills from several disciplines combined in a high-level and intrinsically collaborative research project, key transferable skills on information technology, written and oral communication and critical assessment, and key business and commercial skills on commercial exploitation and product development.

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**NBR: 238177** **ACRONYM: SUPERIOR** **EC FUND: 3793675**

**DG:** REA **Call: FP7-PEOPLE-ITN-2008** **Thema:** FP7-PEOPLE-ITN-2008

**Title:** SUPramolEculaR functional nanoscale archItectures for Organic electronics: a host-driven network

**Abstract:** SUPERIOR aims at providing top-quality cross-disciplinary and supra-sectoral training to a pool of promising young researchers, in an area at the interface between Supramolecular Chemistry, Materials- and Nano-Science, Physics and Electrical Engineering. SUPERIOR appointees will be formally trained in lecture courses, dedicated schools and workshops, and through an ambitious and carefully planned research activity that benefits both from the expertise of world-leading senior investigators and

of younger and energetic PIs with remarkable track records in both training and research. SUPERIOR is designed to generate new scientific and technological knowledge by combining supramolecularly-engineered nanostructured materials (SENMs), mostly based on organic semiconductors, with tailor-made interfaces to solid substrates and electrodes, for fabricating prototypes of optoelectronic devices. We are particularly interested in developing multiscale SENMs for transistors (FETs), in-plane diodes single-photon emitters, and especially solar cells (PVDs) and organic light-emitting diodes, OLEDs. The specific training and research objectives are: 1. Supramolecular synthetic chemistry of electrically/optically 1D and 2D (macro)molecules 2. Hierarchical self-organisation of multifunctional SENMs at surfaces. Multiscale SPMs studies of physico-chemical properties 3. Time-resolved photophysical studies of single-molecules and SENMs 4. Time-resolved spectroscopy of materials and devices 5. Modelling the geometric and electronic structures and the optical properties of SENMs 6. Advanced devices processing/(nano)fabrication 7. Formation of controlled interfaces of SENMs with substrate and electrodes 8. Devices I: FETs: Measurement of charge mobility in stacks, also upon photodoping. 9. Devices II: PVDs – addressing the charge collection problem. 10. Devices III: Emissive devices - Single photon emitters and OLEDs 11. Dissemination and strategic development 12. Management

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**NBR: 238291** **ACRONYM: MEMTIDE** **EC FUND: 2329000**

**DG:** REA **Call: FP7-PEOPLE-ITN-2008** **Thema:** FP7-PEOPLE-ITN-2008

**Title:** Membrane Enhanced Tide Synthesis - A New Paradigm Peptide / Oligonucleotide Synthesis Technology

**Abstract:** The MemTide Initial Training Network will create a new generation of synthesis technologies for peptide and oligonucleotide ("tide") manufacture, with focus on the use of emerging membrane technology to effect critical separations. New nanofiltration membranes with improved chemical stability, and closely controlled molecular discrimination properties, will be developed. Novel synthesis strategies for tides, which utilise membranes for key separations will be created. MemTide will consider both step change improvements to solid phase tide synthesis, and the realisation of a completely new concept of tide synthesis based on solution phase synthesis coupled to membrane purification. The applications of these technologies will be through the industrial partners. The project is multidisciplinary, involving chemists, materials scientists and chemical engineers. The consortium is intersectorial, comprising 3 universities/research institutes, a technology SME, a fine chemicals company and a large pharmaceutical manufacturer, and will have a strong emphasis on knowledge creation, technology commercialisation, and entrepreneurship. The training programme involves Early Stage Researchers (ESR), at both university and industrial partners, each of whom will complete a PhD thesis through a combination of local and network wide research experience. Experienced Researchers (ER) will complete their training through

development of entrepreneurship and project management skills. ESR and ER will complete complementary training through a series of Personal Skills Modules, and a course on Technology Commercialisation and Entrepreurship. MemTide seeks to contribute to improving the European knowledge supply chain through this industry-academia programme aimed at developing engineers and scientists who are academically excellent and achieve PhD degrees, but who thrive at the interface between fundamental research and industrial application.

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**NBR: 238363** **ACRONYM: CONTACT** **EC FUND: 3477181**

**DG:** REA **Call: FP7-PEOPLE-ITN-2008** **Thema:** FP7-PEOPLE-ITN-2008

**Title:** Marie Curie Initial Training Network for the tailored supply-chain development of the mechanical and electrical properties of CNT-filled composites

**Abstract:** The EU is currently directing intensive research efforts into nanotechnology. Carbon Nanotubes (CNTs), with the electrical conductivity of copper and an E-modulus 10 times greater than steel, are one of the most promising developments, enabling the creation of materials with revolutionary characteristics. The commercial potential is huge, but only a fraction of the possible applications have reached the market. Collaboration is needed between academia and industry, so that processes developed on a laboratory scale can be upscaled for industrial application. This consortium, which achieves an optimal balance between academia and industry (50:50) in the field of CNTs, and which spans the entire value added chain from CNT synthesis to implementation in saleable products, is convinced that the 576 person-months spent on this project will achieve this aim. 18 researchers, in unique collaboration with cutting-edge teams, will work to overcome recognised limitations in the state of the art, including the adjustment of CNT surface properties, CNT dispersion in thermosets and thermoplastics, reliable analysis and characterisation. Carefully structured networking will ensure the efficient exchange of knowledge between researchers, the partners and society. Focus on 3 specific end-use applications (construction, wind blades, electrodes) will ensure quantifiable and tangible results. The predicted growth of nanotechnology can only be sustained through the education of scientists. The vast teaching experience of the partners will ensure a high-quality training program. Through mentoring by world-class researchers, conferences, courses ranging from leadership for women to presentation skills, interdisciplinary and intersectoral experience, the appointed researchers will gain scientific know-how and the complementary skills necessary to exploit it. The S&T and training elements will combine to form a structured program, adaptable to each researcher's needs.

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**NBR: 238382** **ACRONYM: MANETEI** **EC FUND: 3832975**

**DG:** REA **Call: FP7-PEOPLE-ITN-2008** **Thema:** FP7-PEOPLE-ITN-2008

**Title:** Management of Emergent Technologies for Economic Impact

**Abstract:** The ManETEi network offers a research-led training programme to create a rigorous collaborative research agenda centred on the multifaceted phenomenon of managing emergent technologies for maximum economic and societal impact. It will have advanced capacity-building and career development that will benefit the early-career and experienced researchers needed to ensure Europe becomes a leading knowledge economy driven by its unique ERA. The network has identified arguably Europe's most important opportunity for its future management researchers, managers and policy makers. The investment by Member states, EU and industry in Bio-, Nano-, Info- and cognitive (NBIC) emerging science and technology are making jointly is the largest ever seen. This creates a need for both increased capacity and new competencies in business and management for linking advances in emerging technology with business and economic exploitation. Yet demographic studies indicate Europe's management training and research capacity is set to decline. ManETEI brings together 7 of Europe's leading Business Schools, the Fraunhofer ISI, an European global high technology manufacturer (Bayer GmbH) supported by a diverse group of associate partners from different industries, sectors, technologies and countries. They will provide a stimulating and active learning environment to enhance trans-national mobility, inter-institutional experience and exposure to a range of scholarly perspectives from the disciplines of management, economics and technology. It will create a platform for researchers to investigate the multifaceted phenomenon of managing the emergent technologies that promise the greatest competitiveness and growth of the European economies. The network members are highly experienced in participating in EU funded research and its implementation at all levels. They all share commitment for future research and training collaboration based on the principles created by this network.

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**NBR: 238409** **ACRONYM: ENHANCE** **EC FUND: 3697708**

**DG:** REA **Call: FP7-PEOPLE-ITN-2008** **Thema:** FP7-PEOPLE-ITN-2008

**Title:** European Research Training Network of â€œNew Materials: Innovative Concepts for their Fabrication, Integration and Characterizationâ€•

**Abstract:** The multi-site European initial training network – "ENHANCE" – "New Materials: Innovative Concepts for their Fabrication, Integration and Characterization" will be established to deal with the mid and long term issues of concern to the European industry encompassing the whole spectrum of functional materials for microelectronics, nano-electronics, data storage, photovoltaic, with emphasis on emerging nano-technologies. This network consisting of 3 academic groups from chemistry 1 from

physics, 3 from Material Science and Engineering and 1 industrial partners from 6 different countries of Germany, Finland, Netherlands, Italy, Denmark and Austria. Despite the exceptional importance of thin film processing of many new materials and their integration in emerging nanotechnologies, there is no systematic interdisciplinary training of students in the traditional courses of chemistry, materials science and engineering. ENHANCE aims to close this gap by combining the classical knowledge of chemistry, materials science, physics and engineering i.e. the knowledge of precursor molecules, materials properties, study of physical phenomena, to electronic devices and circuit integration. The training of ENHANCE fellows will be based on a structured 3 year academic curriculum, including, generic skills workshops and on-site research training at the state of the art laboratories, facilities under clean room conditions and a training at the industrial laboratories. This will provide the young scientists with necessary in-depth knowledge in materials synthesis and thin film processing as well as experimental skills in operating the instruments and analytical skills in different materials characterization techniques. The training concludes with European doctoral examination and will be reviewed by external experts in the field and their remarks will be addressed during the final disputation.

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**NBR: 238700** **ACRONYM: NANOPOLY** **EC FUND: 2702706**

**DG:** REA **Call: FP7-PEOPLE-ITN-2008** **Thema:** FP7-PEOPLE-ITN-2008

**Title:** Hybrid Models for Tailoring Nano-Architectures of polymers

**Abstract:** The large scale production of commodity polymers is increasingly shifting overseas. Europe still plays a major role in polymer processing and product development, but the competition with the US and Asia requires distinctive efforts to sustain this leadership. Thus, it is decisive for European researchers and companies to design innovative, specialised commodities and optimise current production strategies. NANOPOLY's main scientific objective is to further create, exchange and spread-out such know-how systematically within a European network in order to make this progress available and exploitable for European industries and coming generations of researchers. NANOPOLY will be unique in combining the strengths of applied mathematics/software engineering on the one hand and macro-molecular chemistry/reaction engineering on the other hand. These two sets of competences are currently rather unrelated but represent an important source of innovation for creating new models and associated software tools that permit new rational designs of polymer materials. NANOPOLY's main training objective is the education of a new generation of researchers who are able to bridge the still significant gap between the two mentioned sets of competences. The job market urgently calls for researchers with suchlike sophisticated knowledge and interdisciplinary training. These prospects will make participation in the network a rewarding career option. Through superior training, intense cooperation, and outreach the network will build-up an exeptional multi-disciplinary, European-based community

that is able to achieve the crucial transfer of knowledge between the associated fields and thus permit major innovation in improving technological processes that allow tailoring nano-architectures of polymers to specific requirements.

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**NBR: 238804** **ACRONYM: SMALL** **EC FUND: 4899085**

**DG:** REA **Call: FP7-PEOPLE-ITN-2008** **Thema:** FP7-PEOPLE-ITN-2008

**Title:** Surfaces for molecular recognition at the atomic level

**Abstract:** The overarching aim of the SMALL ITN project is to train Early Stage Researchers in the field of 'molecular recognition at surfaces' from fundamental science to novel applications. For this task, SMALL combines European experts from surface science, nanotechnology, theory, chemical synthesis, physics, biology and industry, and thus takes a highly integrated approach to the training. The researchers will work within a well-structured scientific programme aimed at molecular recognition, underpinning the next generation of molecular sensors, catalysis, biomimetics, and molecular electronics. The programme of training will foster scientists who, in addition to being specialists in particular branches of molecular nanotechnology, have broad interdisciplinary experience in the experimental and theoretical techniques of molecular nanotechnology. Their hands-on training will be substantiated by a well-developed network training programme which will address both scientific and complementary skills. In their projects, the Early Stage Researcher will explore the nature of the interactions responsible for molecular and atomic recognition and the role that these play in the massively parallel self-assembly of supramolecular nanostructures, using a collaboration of cutting edge experimental and theoretical techniques. They will investigate how to achieve chemical selectivity at surfaces, including enantioselective recognition, by molecular and atomic surface modification as a route to novel catalysis and nanoscale sensors, drawing on expertise across different scientific disciplines and pioneering industrial partnerships.

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**NBR: 239183** **ACRONYM: RNAI IN HSC VIA NP** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-IRG-2008** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Delivery of siRNAs to hematopoietic stem cells using nanoparticles

**Abstract:** RNA interference (RNAi) is a ubiquitous and highly specific, endogenous, evolutionarily conserved mechanism of gene silencing. Since the discovery that RNAi occurs in mammalian cells, RNAi has emerged as a powerful tool for elucidating gene function and identifying potential drug targets. Harnessing RNAi holds enormous promise for

therapeutic use for diseases that have proven difficult to treat with conventional drugs. RNAi can also be exogenously activated either by transducing cells with vectors to express small hairpin RNAs (shRNA) or by introducing already processed short double-stranded RNAs (siRNAs) into the cytoplasm of cells. To realize the potential of siRNAs for in vivo drug discovery and therapy there is a need to overcome the considerable hurdle of intracellular delivery across the plasma membrane. siRNAs are not taken up into most cells in vitro in the absence of a transfection reagent. For many cells, mixing siRNAs at nanomolar concentrations with a lipid transfection can efficiently induce gene silencing. However, some important cells, including primary lymphocytes and hematopoietic stem cells, remain highly resistant to lipid transfection schemes. We have recently developed nanoparticles that target integrin b7 that is expressed on leukocytes involved in gut inflammation. Using this approach, we revealed cyclin D1 to be a potential anti-inflammatory target in inflammatory bowel diseases. The goal of this proposal is to explore the hypothesis that targeted nanoparticles entrapping siRNAs can be developed to induce in vivo gene silencing in hematopoietic stem cells. Using this strategy, we plan to identify key genes responsible for pluripotent hematopoietic stem cells (pHSC) self-renewal properties. This will provide a powerful technique to investigate the contribution of individual genes in maintaining the phenotypic and functional properties of pHSC, and ultimately may provide a way to improve engraftment during bone marrow transplantation.

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**NBR: 239223** **ACRONYM: NANOQUANTUMDEVICES** **EC FUND: 45000**

**DG:** REA **Call: FP7-PEOPLE-ERG-2008** **Thema:** PEOPLE-2007-2-2.ERG

**Title:** Fabrication and Electron Transport Study of Nanowire based Quantum Devices

**Abstract:** The investigation of the transport properties of nanoscaled objects is a strongly expanding field of nowadays solid-state physics, it attracts increasing attention either in applied science due to the potential in future applications or in basics research due to exciting quantum effects on the nanoscale. Semiconducting nanowires (NW) are single crystals with a typical diameter of 10-100nm and length of 5-10microm. Fabricating metallic leads to NWs, devices can be produced, where the electron density can be strongly varied by gates and the transport can be explored from the quasi-ballistic to the quantum dot regime. Due to their exceptional properties (e.g. band structure engineering, possibility to contact them with ferromagnetic (F), superconducting (S) leads, local gating), NW based devices open a new horizon in quantum transport. In order to be competitive in the field of experimental quantum electronics, it is essential to own sample fabrication facilities, which has not been available in the host institute. The main aim of this proposal is to set up the environment of device fabrication, which will be based on a Jeol scanning electron microscope equipped with lithography unit. The applicant will fabricate and investigate the low temperature transport properties of InAs NW based devices focusing mainly on spin injection from ferromagnetic leads and

on F-S hybrid nanostructures. The fabrication facility will also support other ongoing quantum electronic projects.

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**NBR: 239256** **ACRONYM: DOTUBE** **EC FUND: 45000**

**DG:** REA **Call: FP7-PEOPLE-ERG-2008** **Thema:** PEOPLE-2007-2-2.ERG

**Title:** DOTUBE: Interactions between semiconductor nanoparticles and carbon nanotubes

**Abstract:** Many applications in Nanotechnology require the complete understanding of the material`s surface in order to control further interactions against specific targets. The goal of the proposal is to understand the interaction between CdSe nanoparticles and carbon nanotubes (or graphene) as well as the chemical reactivity of such composites. We will investigate the ligand environment of the CdSe nanoparticles attached to carbon nanotubes by means of Nuclear Magnetic Resonance (NMR) spectroscopy as main investigation technique. We expect to obtain evidences of the structural properties (composition of the connected facet), type of interaction (coordinative or ionic) and to evaluate the strength of the bond. Once we understand the cited information, we also expect to improve the carrier injection into the tube by proper chemical functionalization. The results of the chemical studies will be applied to understand the interaction between nanoparticles and carbon nanotubes and to optimize the photoelectrical response.

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**NBR: 239303** **ACRONYM: NANO-RC** **EC FUND: 45000**

**DG:** REA **Call: FP7-PEOPLE-ERG-2008** **Thema:** PEOPLE-2007-2-2.ERG

**Title:** Preparation of novel materials by filling carbon nanotubes

**Abstract:** The remarkable physical properties of carbon nanotubes (CNTs), have led to much interest in the potential for their application in many diverse directions. There are many examples in which the cavity of CNTs has been filled with a variety of compounds, including organic molecules, fullerenes, inorganic salts, water and metals. The aim of this project is to prepare new nanomaterials by filling CNTs and explore their potential applications. The method used to fill steam purified and opened CNT will depend on the characteristics of the material to be encapsulated, being the most commonly used routes the solution filling, melting filling and vapour filling. We propose to optimise the process for the filling of carbon nanotubes and the removal of the external material (from the filling experiment); to prepare and characterize nanoscaled materials which properties can differ significantly from the bulk material, and to fill carbon nanotubes with materials of interest for medical applications.

**NBR: 239313** **ACRONYM: NANOLUM** **EC FUND: 45000**

**DG:** REA **Call: FP7-PEOPLE-ERG-2008** **Thema:** PEOPLE-2007-2-2.ERG

**Title:** Luminescently doped nanoparticles. Strategies for improving sensitivity in luminescence assays and implementation in microarray formats.

**Abstract:** This project aims to take advantage of polymeric nanoparticles as a tool for improving sensitivity and performance of (chemi)luminiscence based assays. For instance, highly emissive red/near-infrared (NIR) dyes and long-lifetime luminophores like Ru(II) complexes will be combined in nanoparticles for increased emission efficiencies, better discrimination from background interferences and improved photostability. These beads will be employed for labelling antibodies to be used in immunoassays. Several strategies will be explored, taking advantage of FRET processes, (chemi)luminescence of Ru(II) complexes and high emission efficiencies of red/NIR boron-dipyrromethene (BODIPY) dyes. Additionally, the use of molecularly imprinted polymers (MIPs) as synthetic analogues of antibodies will be explored for the selective recognition and fluorescent indication of analytes containing carboxylic groups. The fabrication of the MIP fluorescent probes in a nanoparticle or core-shell nanoparticle form is expected to improve response time of the sensor and binding of the target analyte, and to allow ratiometric measurements or indication via energy transfer processes. The main task will cover the synthesis of luminescent molecular probes, nanoparticles and luminescently doped nanoparticles and MIPs, with a complete physical and photophysical charaterization. These particles will be implemented in a final stage onto microarray based technologies for monitoring the presence of certain toxins and antibiotics in water and aquaculture products.

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**NBR: 239322** **ACRONYM: TUN-CNT** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-IRG-2008** **Thema:** PEOPLE-2007-4-3.IRG

**Title:** Studies of One-Dimensional Tunneling in Carbon Nanotubes

**Abstract:** Quantum tunneling, the ability of electrons to pass through classically forbidden barriers, has been an invaluable tool in the studies of fundamental electronic properties in condensed-matter systems. The tunneling between two conductors reflects their density-of-states and the properties of their separating barrier and as such can be used to determine these quantities with large accuracy. In this work we will use tunneling experiments to study the fundamental properties of electrons in carbon nanotubes (NT). Here, two unique features make tunneling particularly intriguing – the relativistic-like

dispersion of the electrons, and their one-dimensional confinement, which renders them into collective excitations. We will use novel NT device architectures that will allow us to create tunneling barriers of arbitrary shapes, to control the properties of the tunneling electrons and to reach the limit of ultra-clean NTs and ultra-strong interactions between electrons. These devices will be utilized to study a varied set of questions: To what extant can the tunneling in NTs be explained by single-particle Zener-like tunneling? Does the relativistic-like nature of electrons lead to Klein paradoxes in tunneling across a sharp barrier? What are the effects of electronic interactions in the tunneling? What are the roles of disorder and number of one-dimensional channels in the tunneling? Can we discover the recently predicted strongly-interacting spin-incoherent liquid of electrons, which is expected to have a unique tunneling signature? Finally, we would use tunneling experiments as a sensitive tool to study the nature of the yet poorly understood small band-gaps in carbon nanotubes. These studies will address for the first time some core questions about electrons in low-dimensions and will also determine the quantum limits for using NTs in electronic device applications.

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**NBR: 239331** **ACRONYM: OPTOELECTRONIC_DCA** **EC FUND: 45000**

**DG:** REA **Call: FP7-PEOPLE-ERG-2008** **Thema:** PEOPLE-2007-2-2.ERG

**Title:** Advanced optoelectronic materials through dynamic combinatorial assembly

**Abstract:** Electronically conducting organic materials could potentially revolutionize future opto-electronic technologies, because they are tunable at the molecular level, easily processable, cheap, mechanically flexible, and can form nanoscale structures through bottom-up supramolecular self-assembly. The combination of organic synthesis and supramolecular chemistry can play a crucial role in attaining all these goals, providing a gateway to structures of a high complexity at length scales where both classical organic synthesis and top-down engineering break down. Here, I propose a new approach to making semiconducting nanoscale structures with tunable properties through self-assembly of graphene subcomponents. Graphene, a flat, one-atom thick sheet of graphite, is likely to play a crucial role in nanotechnology, potentially replacing silicon in future electronic devices. Graphenoids have a tendency to form columnar superstructures leading to large conductivities and other interesting optoelectronic properties. The aim of this project is to synthesize graphenoids that are capable of forming reversible covalent bonds amongst each other, and study their hierarchal self-assembly into well-defined, large, multicomponent conducting organic structures through dynamic combinatorial assembly and subsequent directional aggregation. These graphene nanostructures will be studied using state-of-the-art techniques, and their device performance, in for instance solar cells or LEDs, will be investigated. It is expected that these nano-engineered materials will show improved performance stemming from their nano-scale order, functionalization and compartmentalization. By funding European nanoscience and knowledge-based multifunctional materials research, one of

the priority themes of the Work Programme, this fellowship will contribute to enhance scientific excellence in the European Union and it will be a first and crucial step towards reintegration of a talented young European researcher.

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**NBR: 239342** **ACRONYM: ALHSOLAR** **EC FUND: 45000**

**DG:** REA **Call: FP7-PEOPLE-ERG-2008** **Thema:** PEOPLE-2007-2-2.ERG

**Title:** Advanced Light Harvesting for Organic based Solar Energy Conversion

**Abstract:** During last years, there has been a strong research effort in order to cut down photovoltaics costs. Several possible alternative technologies to silicon-based photovoltaics have been proposed and Organic PhotoVoltaics (OPV) could represent the cheapest way to convert solar energy into electricity. The Bulk Heterojunction (BHJ) solar cell represents a photovoltaic system that can be processed from solution leading to large area devices on transparent and flexible substrates, using cheap techniques like spin-coating, doctor blading, ink-jet printing and screen-printing, in conformity with the request of low cost photovoltaics. One major obstacle to be overcome is the low Power Conversion Efficiency (PCE) that has been demonstrated up to now, a maximum of about 5%. Various parameters influence the low efficiency: among the others, PCBM, a soluble fullerene derivative, is the almost exclusive n-type material (acceptor) in these devices, obliging to optimize the donor in a particular device configuration; only a little amount of the solar spectrum is involved in the energy conversion process; charge carrier mobility is lower than the one of inorganic counterparts, only partly balanced by a higher absorption coefficient and a higher charge mean lifetime. The major objectives to be achieved in the present proposal framework are: 1) to study the optical and the electronic properties of new low-bandgap materials, both polymers and inorganic nanoparticles, as donor phase to be used in BHJ solar cells; 2) to study the optical and electronic properties of inorganic nanoparticles to be used as acceptor phase in BHJ solar cells. 3) to optimize the device structure in order to increase the fraction of absorbed photons from the incoming solar photon flux studying the light harvesting by Resonant Surface Plasmon coupling; 4) to optimize the light harvesting by Resonant Energy Transfer and/or new conceptual spectral shaping.

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**NBR: 239382** **ACRONYM: NF-RAD** **EC FUND: 75000**

**DG:** REA **Call: FP7-PEOPLE-IRG-2008** **Thema:** PEOPLE-2007-4-3.IRG

**Title:** NF-RAD: Near-Field Radiation Absorption and Scattering by Nanoparticles on Surfaces"

**Abstract:** The process of engineering, controlling and fabricating structures of 1-100 nanometers in size, which defines "nanoscale," is a challenging endeavor. The unusual characteristics of such particles are due to their small sizes and high percentage of atoms in surface states, which yield unique properties that differ from those of the same bulk materials. Particularly, nanosize metallic particles and colloids can give rise to many unprecedented optical, electronic, and structural properties. With these new properties, these particles can be used for many novel and innovative engineering and biological applications. However, manufacturing of these nanosize building blocks requires careful control of their composition, structure, shape, and size distribution, which necessitates further understanding of the underlying physics and chemistry. This would be possible if these particles can be visualized and measured in real time and non-intrusively. Recently, a new characterization methodology has been developed by the PI and his group using scattering of elliptically polarized evanescent waves by particles on a smooth surface. These surface waves can also be employed to manipulate particles. Again recently, the PI and his colleagues reported a novel directed self-assembly process to melt and fuse metallic of such particles. The objective of the current proposal is to advance both of these approaches to the next level by understanding the influence of near-field effects on absorption, emission and scattering by nanoparticles, coagulates and surfaces in close proximity to each other. It is expected that a successful implementation of this research program will significantly help to the development of future nanomanufacturing platforms. The Marie Curie International Reintegration Project will help the PI to seamlessly transfer the knowledge base he has developed at the University of Kentucky in Lexington, Kentucky, USA, to Ozyegin University, in Istanbul Turkey.

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**NBR: 239384** **ACRONYM: PHOTOCAT** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-IRG-2008** **Thema:** PEOPLE-2007-4-3.IRG

**Title:** Photoinduced Catalysis in a Nanoparticle System

**Abstract:** Metal nanoparticles (NPs) have been studied intensely in the last decade due to their novel optical, catalytic and electronic properties. Because of the nanoscopic size of NPs, self-assembly has been by far the most important means of generating higher-order architectures. Light is a particularly attractive means to self-assemble of NPs because it can be delivered instantaneously and into a precise location. In order to render NPs photoactive, their surfaces need to be functionalized with photoresponsive ligands. As an incoming Independent Researcher at the Weizmann Institute of Science, the Applicant wishes to develop new nanomaterials resulting from this marriage of nanoscience and organic chemistry. The Applicant has extensive experience in the fields of nanoscience and organic chemistry, acquired during the last several years at Northwestern University, USA. In the proposed project, he would like to develop a NP-based system, in which catalysis is regulated by light. This system takes advantage of his

previous research, which has shown that NPs can be reversibly assembled and disassembled using light (PNAS 2007, 104, 10305; Science 2007, 316, 261). For NPs decorated with mixed monolayers comprising photoswitches and molecular catalysts, disassembly of such aggregates will result in a drastic increase of a catalytic surface area exposed to the solvent, and therefore in effective catalysis of a model reaction. As a result, self-assembly process will be transduced into catalytic activity. The system will then be extended to include various types of NPs functionalized with mixtures of different photoswitches and catalysts. These NPs will assemble / disassemble when exposed to different wavelengths of light. The ultimate goal of the project is to demonstrate that in a complex mixture of mutually incompatible chemicals, reactions can be turned "on" and "off" using light of different wavelengths, in a way similar to enzymatic regulation of reactions in living cells.

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**NBR: 239426** **ACRONYM: POLYPATT** **EC FUND: 30000**

**DG:** REA **Call: FP7-PEOPLE-ERG-2008** **Thema:** PEOPLE-2007-2-2.ERG

**Title:** Control and Application of Field Induced Polymer Patterns

**Abstract:** Strong electric field gradients can produce forces that overcome the surface tension in a thin liquid polymer film to induce instabilities at the film surface. It is possible in this way to create structure in polymer films on a nanometre length scale. Understanding how the resultant patterns form has significant potential for improving nanodevice fabrication techniques but may also lead directly to the discovery of novel nanodevices. As part of the PATTERNs RTN, over 35 months the applicant has worked with some of the leading researchers in the thin film polymer instabilities field, and has been fully trained in the relevant experimental and theoretical methods. He has developed a new theoretical model that describes a polymer-air-polymer system under electric field and he has explored this system, not only theoretically but experimentally. The applicant has validated his theoretical model, and explored comprehensively the polymer type, thickness and viscosity parameter space of this system to provide new insights into the nucleation and spinodal processes responsible for the observed pattern formation. The experimental results are however from static measurements, and so detail of the dynamic instability formation process remains obscured. He proposes therefore to study the real-time formation of the polymer instabilities using a newly acquired optical 3-D topographic instrument modified for this purpose. In addition, the ambition of fabricating nanodevices based on these polymer instabilities requires an increased level of experimental control, and the coupling of these instabilities with nanoparticle inclusion for self-organisation into nanodevices (such as photonic crystals) is at the forefront of current research and still not well understood. He proposes therefore to develop new methods for controlling the experimental polymer instability system, and to use this control to allow fabrication and characterization of nanoparticle self-organised devices.

**NBR: 239459** **ACRONYM: FILMMOLECSTRUCT** **EC FUND: 45000**

**DG:** REA **Call: FP7-PEOPLE-ERG-2008** **Thema:** PEOPLE-2007-2-2.ERG

**Title:** Molecular Structure in Thin Wetting Films

**Abstract:** The proposed project intends to obtain a molecular insight into the order and structure of thin wetting films (solid/liquid/gas) as an effort to relate molecular properties to macroscopic measureable parameters such as surface forces and contact angles. The approach will consist in combining two powerful surface sensitive vibrational spectroscopic techniques (Vibrational Sum Frequency and Total Internal Reflection Raman spectroscopies) with an apparatus capable of measuring the forces exerted between these asymmetric surfaces as a function of distance (Thin Film Pressure Balance). VSFS is intrinsically surface specific probing the first few monolayers and detecting only molecules with a preferred orientation. Conversely, TIR Raman probes deeper into the bulk (~100 nm), but detects all molecules making these two techniques complementary. Results will provide unique information on the structural changes in nanometer confined geometries of i) pure water films, ii) surfactant and polymer stabilized films and iii) biophysical relevant surfaces (planar supported lipid bilayers). The project will involve close collaboration between two research groups in Europe (Germany and England), and will help developing the applicant's independent research skills during his period of reintegration. The applicant's unique experience in surface vibrational spectroscopy and molecules under confinement, learnt particularly during his previous Marie Curie fellowship, will be decisive in the successful implementation of this challenging project.

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**NBR: 239582** **ACRONYM: POLYDOT** **EC FUND: 1299960**

**DG:** ERCEA **Call: ERC-2009-StG** **Thema:** ERC-SG-PE4

**Title:** Control of the Electronic Properties in Hybrid- Quantum Dot/Polymer-Materials for Energy Production

**Abstract:** The PolyDot project aims to foster necessary progress on frontier research that integrates a number of leading concepts in the field of photoelectrochemistry in association with new concepts from areas such as nanoscience and materials chemistry. As an example, key scientific elements of the PolyDot project are the synthesis of new molecular electronic components, such as semiconducting quantum dots, the design of self-organising functional interfaces through supramolecular interactions and the evaluation of these systems for its potential technological application as light driven

energy supplier devices. Thus, the proposal is at the meeting point between supramolecular chemistry, nanostructured inorganic materials science and optoelectronic device physics. It is therefore highly multidisciplinary and involves my research group, which is working in the device physics characterisation and materials science fields. We believe that this project will develop a critical mass of expertise targeting this innovative approach towards solar powered devices allowing Europe to establish a scientific world lead and will also form a secure basis for renewable energy technological exploitation.

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**NBR: 239599** **ACRONYM: NARESCO** **EC FUND: 1260000**

**DG:** ERCEA **Call: ERC-2009-StG** **Thema:** ERC-SG-PE7

**Title:** Novel paradigms for massively parallel nanophotonic information processing

**Abstract:** In this project we will develop nanophotonic reservoir computing as a novel paradigm for massively parallel information processing. Reservoir computing is a recently proposed methodology from the field of machine learning and neural networks which has been used successfully in several pattern classification problems, like speech and image recognition. However, it has so far mainly been used in a software implementation which limits its speed and power efficiency. Photonics could provide an excellent platform for such a hardware implementation, because of the presence of unique non-linear dynamics in photonics components due to the interplay of photons and electrons, and because light also has a phase in addition to an amplitude, which provides for an important additional degree of freedom as opposed to a purely electronic hardware implementation. Our aim is to bring together a multidisciplinary team of specialists in photonics and machine learning to make this vision of massively parallel information processing using nanophotonics a reality. We will achieve these aims by constructing a set of prototypes of ever increasing complexity which will be able to tackle ever more complex tasks. There is clear potential for these techniques to perform information processing that is beyond the limit of today's conventional computing processing power: high-throughput massively parallel classification problems, like e.g. processing radar data for road safety, or real time analysis of the data streams generated by the Large Hadron Collider.

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**NBR: 239603** **ACRONYM: SMARTDRUGENTITIES** **EC FUND: 1400000**

**DG:** ERCEA **Call: ERC-2009-StG** **Thema:** ERC-SG-PE5

**Title:** Sophisticated Well-Targeted Therapeutic Entities based on Biologically Compatible Ti(IV) Active Cores and Building Blocks

**Abstract:** I propose to develop sophisticated anti-tumor agents targeted particularly to the location of activity. My team has recently introduced a new family of Ti(IV) complexes that demonstrates higher activity than known compounds with substantially higher stability and defined hydrolytic behavior, properties that were found to be essential. I propose to study various derivatives and identify the parameters affecting activity, including steric and electronic effects, enantiomeric purity, ligand lability etc., and elucidation various mechanistic aspects of reactivity. More importantly, I propose to construct pH-sensitive transport units that will allow protection of the sensitive active species throughout their delivery and release only near the target location based on the variable pH conditions of different human tissues. In particular, unique spherical molecules held together by metal-ligand interactions will be prepared. The building blocks will consist of the planar ligands of C3-axis bound to three biocompatible Ti(IV) ions each with defined angles and geometry. The resulting spherical compounds will be utilized to encapsulate the active complexes and release them upon hydrolysis at the desired pH based on the pH-dependent hydrolysis pattern already established for related compounds. Preliminary calculations have confirmed the possibility of forming these compounds, which are particularly matching in their expected size to encapsulate our complexes. Larger spheres will also be prepared as cavities for larger molecules, which may be linked together for the delivery of multiple drugs. These compounds may find applications in various areas where a protected environment or delivery of sensitive compounds is required, such as in gene therapy, nano-technology, and catalysis.

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**NBR: 239694** **ACRONYM: COMBOS** **EC FUND: 650000**

**DG:** ERCEA **Call: ERC-2009-StG** **Thema:** ERC-SG-PE1

**Title:** Collective phenomena in quantum and classical many body systems

**Abstract:** The collective behavior of quantum and classical many body systems such as ultracold atomic gases, nanowires, cuprates and micromagnets are currently subject of an intense experimental and theoretical research worldwide. Understanding the fascinating phenomena of Bose-Einstein condensation, Luttinger liquid vs non-Luttinger liquid behavior, high temperature superconductivity, and spontaneous formation of periodic patterns in magnetic systems, is an exciting challenge for theoreticians. Most of these phenomena are still far from being fully understood, even from a heuristic point of view. Unveiling the exotic properties of such systems by rigorous mathematical analysis is an important and difficult challenge for mathematical physics. In the last two decades, substantial progress has been made on various aspects of many-body theory, including Fermi liquids, Luttinger liquids, perturbed Ising models at criticality, bosonization, trapped Bose gases and spontaneous formation of periodic patterns. The techniques

successfully employed in this field are diverse, and range from constructive renormalization group to functional variational estimates. In this research project we propose to investigate a number of statistical mechanics models by a combination of different mathematical methods. The objective is, on the one hand, to understand crossover phenomena, phase transitions and low-temperature states with broken symmetry, which are of interest in the theory of condensed matter and that we believe to be accessible to the currently available methods; on the other, to develop new techiques combining different and complementary methods, such as multiscale analysis and localization bounds, or reflection positivity and cluster expansion, which may be useful to further progress on important open problems, such as Bose-Einstein condensation, conformal invariance in non-integrable models, existence of magnetic or superconducting long range order.

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**NBR: 239739** **ACRONYM: STEMOX** **EC FUND: 1700000**

**DG:** ERCEA **Call: ERC-2009-StG** **Thema:** ERC-SG-PE3

**Title:** Under the light of electrons

**Abstract:** Here, we propose to explore and characterize new emerging phenomena in low dimensional (LD) and artificially structured oxide based systems by means of advanced electron microscopy techniques. Complex oxides have a large range of applications, since their properties change drastically as their precise composition and structure changes. When obtained in LD configurations new functionalities arise which are of fundamental interest in electronics, spintronics, energy or nanophotonics. We will use atomic resolution imaging and spectroscopy in the aberration corrected electron microscope to map their electronic, optical and magnetic properties by means of electron chiral dichroism. We intend to combine spectroscopic magnetic imaging with plasmonic measurements in order to explore, for the first time ever, the sensitivity of electron spectroscopy to magneto-optical properties at high spatial resolution. Our scientific mission will be to a) synthetize and characterize high quality oxide based LD systems and develop new imaging techniques, in order to b) explore new phenomena in systems showing unexpected behaviors. Our approach relies on comprehensive studies with atomic resolution, in real space, and when possible, at work (under the relevant temperature or pressure conditions). We will combine experiments with theory in order to interpret results and design new avenues to follow. This proposal has also a dual strategic component: 1) to create a new group in Spain devoted to study materials physics in such a way, and 2) to establish a world-class collaboration connecting the group to established growers and theorists, assembling a multidisciplinary team. The potential payoffs we envision are large, and many new and unusual materials, devices and phenomena are anticipated.

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**NBR: 239743** **ACRONYM: UPCON** **EC FUND: 1286000**

**DG:** ERCEA **Call: ERC-2009-StG** **Thema:** ERC-SG-PE5

**Title:** Ultra-Pure nanowire heterostructures and energy CONversion

**Abstract:** This proposal is devoted to the synthesis of ultra-pure semiconductor nanowire heterostructures for energy conversion applications in the photovoltaic domain. Nanowires are filamentary crystals with a very high ratio of length to diameter, the latter being in the nanometer range. Nanowires are of significant interest owing to their large surface-to-volume ratio and low-dimensional properties, as well as attractive building blocks of novel devices, including for novel energy conversion applications. The most widely employed nanowire growth method relies on the use of gold, which is known to be an impurity limiting mobility and carrier lifetime in semiconductors. It is generally realized that nanowires with higher purity could enable significant advances in both fundamental studies and technological applications. This proposal combines two complementary and essential aspects of semiconductor nanowires: (i) synthesis in extremely clean conditions and (ii) their application to new concepts of photovoltaic devices. The first part involves the use of Molecular Beam Epitaxy (MBE) system for the synthesis of III-V semiconductor nanowires and heterostructures. Special emphasis will be given in the synthesis of new heterostructure designs, i.e. across the nanowire radius and along the growth axis. The fabrication of ordered arrays of nanowires on large areas and on silicon substrates will also be investigated. In the second part, nanowire based solar cells will be designed, fabricated and characterized. Particular emphasis will be given toward understanding the role of geometry and interfaces in the energy conversion efficiency of the novel nanowire-based solar cells. Here, the high cleanliness and precise heteroepitaxial growth of MBE nanowires will allow us to perform fundamental studies, generating ground-breaking knowledge on the microscopic processes in energy conversion. This project will foster the use of nanotechnology in the energy challenges of the XXI century.

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**NBR: 239831** **ACRONYM: ORGELNANOCARBMATER** **EC FUND: 1700000**

**DG:** ERCEA **Call: ERC-2009-StG** **Thema:** ERC-SG-PE5

**Title:** A Universal Supramolecular Approach toward Organic Electronic Materials and Nanostructured Carbonaceous Materials from Molecular Precursors

**Abstract:** Research in novel energy sources, efficient energy storage, sustainable chemical technology, and smaller microelectronic devices with interfaces for biological systems are among the current challenges in science and technology. Carbonaceous materials and organic electronic materials which speak the language of biomaterials will play a

central role in the search for possible solutions. We aim to develop a universal supramolecular approach for their preparation and propose to develop synthetic pathways toward conjugated oligomers carrying hydrogen-bonded substituents, such as oligopeptide-polymer conjugates. These substituents serve as a supramolecular motif promoting the aggregation of the molecular precursors into single crystals, thin films, or soluble one-dimensional nanostructures. The obtained ordered phases or nanostructures from conjugated molecules themselves are highly interesting candidates for applications in photovoltaic, light-emitting, or semiconducting devices. Related nanostructures from oligo(phenylene)s or oligo(ethynylene)s will serve as reactive molecular precursors for a conversion into soluble graphene ribbon nanostructures. Finally, this approach will be extended toward the preparation of carbonaceous materials from amphiphilic oligo(ethynylene)s as energy-rich molecular precursors under preservation of the mesoscopic morphology, surface chemistry, and carbon microstructure. The obtained materials are highly interesting with respect to ion or hydrogen storage, and transition-metal-free catalysis. Hence, this research project aims to combine synthetic organic chemistry, supramolecular chemistry, and materials science in order to both deliver novel materials and improve our understanding in utilizing supramolecular-synthetic methods in their preparation.

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**NBR: 239834** **ACRONYM: OXIDESYNERGY** **EC FUND: 1050000**

**DG:** ERCEA **Call: ERC-2009-StG** **Thema:** ERC-SG-PE4

**Title:** Understanding the Atomic Scale Synergies of Catalytically Active Nanoclusters on Metal Oxide Surfaces

**Abstract:** The research theme concerns the application of new experimental methods for atomic-scale characterization of model catalysts based on insulating metal oxides with the goal of exploring the potential for designing new and efficient heterogeneous catalysts by enhanced control of the catalyst structure at the atomic level. This objective will be achieved by a carefully integrated sequence of synthesis, characterization, and reactivity measurements of model catalysts based on insulating metal oxides. The project aims in detail at resolving some pertinent support synergies and size-effects, which have been revealed in catalytic systems. A core challenge and advance, which sets the project apart from previous research, is the application of high-resolution non contact Atomic Force Microscopy (nc-AFM), which is the only available tool that can resolve the atomic structure of insulator surfaces and the morphology of supported nanoclusters. I will combine my proven experience with atom-resolved imaging using nc-AFM with novel methods for synthesizing and analyzing model catalysts, to provide groundbreaking new atomistic insight. A crucial aspect will be the ability to relate nc-AFM observations to actual catalytic properties, and this will be achieved by using complementary surface spectroscopies and reaction measurements performed at real high pressure conditions. I firmly believe that this research strategy can provide the key insight to a significantly

better understanding of the numerous catalytic systems based on insulating metal oxides, and this project will enable me to set up a unique world-class experimental facility for such studies.

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**NBR: 239838** **ACRONYM: NANOCONTACTS** **EC FUND: 1513000**

**DG:** ERCEA **Call: ERC-2009-StG** **Thema:** ERC-SG-PE3

**Title:** Structural and electronic properties of nanoscale metallic contacts fabricated by thermally assisted electromigration

**Abstract:** The key aim of the project is to correlate the electronic transport properties of nanoscale metallic contacts with their structure. The electronic transport properties through a metallic contact of atomic dimensions are governed by the atomic structure and by the chemical properties of the contact as well as by the wave nature of electrons. This leads to plateaus of the conductance measured as a function of contact size that do not necessarily correspond to integer multiples of the conductance quantum. I will investigate whether and how atomic as well as electronic shell effects influence the atomic structure of nanoscale metallic contacts. We will measure both electronic transport properties and structural properties concurrently and determine their mutual relation on each individual contact. The contacts will be fabricated by Joule heating a nanowire until thermally assisted electromigration sets in and thins the nanowire to form a contact. The structural properties of these nanocontacts will be studied using scanning force microscopy and scanning tunneling microscopy with atomic resolution in ultrahigh-vacuum. This approach will allow us to use clean superconducting contacts and to exploit superconductivity in order to study the electronic transport properties of the contacts. The electronic transport properties will be studied employing multiple Andreev reflections to determine the number and transmission coefficient of electronic conduction channels. Eventually, a deeper understanding of the relation between structure and electronic transport properties will be obtained which is a prerequisite to tailor the electronic transport properties of nanoscale metallic contacts.

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**NBR: 239844** **ACRONYM: QOM** **EC FUND: 1670904**

**DG:** ERCEA **Call: ERC-2009-StG** **Thema:** ERC-SG-PE2

**Title:** Quantum Optomechanics: quantum foundations and quantum information on the micro- and nanoscale

**Abstract:** Quantum states of mechanical resonators promise access to completely new experimental regimes of physics: from unprecedented levels of force sensitivity to the

generation of macroscopic quantum superpositions of massive objects containing up to 10^20 atoms. This opens up not only exciting possibilities for novel applications but also allows to (re)address fundamental questions of quantum physics, in particular its relation to the classical world. For this reason the preparation and control of mechanical quantum states has long been an enticing but far fetched goal of breakthrough character. With the advent of micro- and nano-mechanics this goal is at the verge of becoming an experimental reality. The last few years have witnessed unprecedented global progress in pushing mechanical systems towards the quantum regime. A thriving interdisciplinary field has emerged that aims to exploit the tremendous potential that lies in the control of mechanical quantum states. The main idea of this proposal is to combine the tools and concepts of quantum optics with micro- and nano-mechanical systems. Such combination provides a unique and powerful approach that allows, with a minimal set of experimental interactions, universal quantum control over mechanical systems via opto-mechanical interactions. The feasibility of the approach has recently been verified by us and by several other groups worldwide in a series of experimental demonstrations of mechanical laser cooling. The main objective of the proposed research is to go significantly beyond the current state-of-the-art and to develop the field of quantum-opto-mechanics to its full extent, both in experiment and theory. This will also increase the European visibility in this highly topical area of research. My professional background in both solid-state physics and quantum optics and quantum information will be of additional help in this highly interdisciplinary endeavour.

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**NBR: 239865** **ACRONYM: COCOON** **EC FUND: 1432799**

**DG:** ERCEA **Call: ERC-2009-StG** **Thema:** ERC-SG-PE8

**Title:** Conformal coating of nanoporous materials

**Abstract:** CONTEXT - Nanoporous structures are used for application in catalysis, molecular separation, fuel cells, dye sensitized solar cells etc. Given the near molecular size of the porous network, it is extremely challenging to modify the interior surface of the pores after the nanoporous material has been synthesized. THIS PROPOSAL - Atomic Layer Deposition (ALD) is envisioned as a novel technique for creating catalytically active sites and for controlling the pore size distribution in nanoporous materials. ALD is a self-limited growth method that is characterized by alternating exposure of the growing film to precursor vapours, resulting in the sequential deposition of (sub)monolayers. It provides atomic level control of thickness and composition, and is currently used in micro-electronics to grow films into structures with aspect ratios of up to 100 / 1. We aim to make the fundamental breakthroughs necessary to enable atomic layer deposition to engineer the composition, size and shape of the interior surface of nanoporous materials with aspect ratios in excess of 10,000 / 1. POTENTIAL IMPACT Achieving these objectives will enable atomic level engineering of the interior surface of any porous material. We plan to focus on three specific applications where our results

will have both medium and long term impacts: - Engineering the composition of pore walls using ALD, e.g. to create catalytic sites (e.g. Al for acid sites, Ti for redox sites, or Pt, Pd or Ni) - chemical functionalization of the pore walls with atomic level control can result in breakthrough applications in the fields of catalysis and sensors. - Atomic level control of the size of nanopores through ALD controlling the pore size distribution of molecular sieves can potentially lead to breakthrough applications in molecular separation and filtration. - Nanocasting replication of a mesoporous template by means of ALD can result in the mass-scale production of nanotubes.

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**NBR: 239898** **ACRONYM: DYCOCA** **EC FUND: 1400000**

**DG:** ERCEA **Call: ERC-2009-StG** **Thema:** ERC-SG-PE5

**Title:** DYNAMIC COVALENT CAPTURE: Dynamic Chemistry for Biomolecular Recognition and Catalysis

**Abstract:** Molecular recognition plays a fundamental role in nearly all chemical and biological processes. The objective of this research project is to develop new methodology for studying and utilizing the noncovalent recognition between two molecular entities, focussing on biomolecular receptors and catalysts. A dynamic covalent capture strategy is proposed, characterized by the following strongholds. The target itself self-selects the best component out of a combinatorial library. The approach has a very high sensitivity, because molecular recognition occurs intramolecularly, and is very flexible, which allows for an easy implementation in very diverse research areas simply by changing the target. The dynamic covalent capture strategy is strongly embedded in the fields of supramolecular chemistry and (physical) organic chemistry. Nonetheless, the different work programmes strongly rely on the input from other areas, such as combinatorial chemistry, bioorganic chemistry, catalysis and computational chemistry, which renders the project highly interdisciplinary. Identified targets are new synthetic catalysts for the selective cleavage of biologically relevant compounds (D-Ala-D-Lac, cocaine and acetylcholine, and in a later stage peptides and DNA/RNA). Applicative work programmes are dedicated to the dynamic imprinting of monolayers on nanoparticles for multivalent recognition and cleavage of biologically relevant targets in vivo and to the development of new screening methodology for measuring chemical equilibria and, specifically, for the discovery of new HIV-1 fusion inhibitors.

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**NBR: 239931** **ACRONYM: NANOPUZZLE** **EC FUND: 1541310**

**DG:** ERCEA **Call: ERC-2009-StG** **Thema:** ERC-SG-PE5

**Title:** Multifunctional Magnetic Nanoparticles: Towards Smart Drugs Design.

**Abstract:** Nature has been utilizing nanostructures for billion of years. The following two properties, (i) being about the size of typical biological objects and (ii) the possibility of tailoring their properties by changing their size, make nanoparticles attractive for biomedical applications. Using nanoparticles to deliver drugs to tumours offers an attractive possibility to avoid obstacles that occur during conventional systemic drug administration. This NANOPUZZLE project pretends to develop an innovative controlled release methodology, based on hyperthermia and magnetic nanoparticles, as platform for the incorporation of different molecules with different functionalities, to obtain a multifunctional system for cancer treatment and diagnose that leads antitumoral drugs discharge only in the tumoral area. Multifunctional magnetic nanoparticles loaded with a targeting agent (folic acid) and a potent antitumoral drug (doxorubicin) will be prepared. These active molecules will be coupled to the magnetic nanoparticles (MNPs) due to complementary oligonucleotides strands (oligo-zipper). Due to the magnetic properties of these nanomaterials, a local heating induced by an alternating magnetic field, will release the drug in the desired target as a consequence of the DNA denaturation (oligo-unzipping). For this approach, the increase of temperature is only required directly in the nanoparticles and the heating of the surroundings is not needed. For instance, less quantity of nanoparticles and a weaker external magnetic field will be required, avoiding the main inconveniences of conventional hyperthermia treatments. Furthermore, the superparamagnetic properties of these MNPs will also allow their use as contrast agents for tracking and diagnosis by magnetic resonance imaging (MRI).

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**NBR: 239983** **ACRONYM: NUSIKIMO** **EC FUND: 490000**

**DG:** ERCEA **Call: ERC-2009-StG** **Thema:** ERC-SG-PE1

**Title:** Numerical simulations and analysis of kinetic models - Applications to plasma physics and Nanotechnology

**Abstract:** This project is devoted to the mathematical and numerical analysis in statistical physics with a special interest to applications in Plasma Physics and nanotechnology with Micro Electro Mechanical Systems (MEMS). We propose to achieve numerical simulations in plasma physics by fully deterministic methods. Using super-computers, a non stationary collisional plasma can be modelled taking into account Coulombian interactions and self-consistent electromagnetic fields to study different regimes and instabilities. These methods are based on high order and conservative finite volume schemes for the transport and fast multi-grid methods for the treatment of collisions. The first application is the simulation of fast ignition or Inertial Confinement Fusion, which is an important issue in plasma physics. Here, the main difficulty concerns the modelling of collisions of relativistic particles and the development of new algorithms for their treatment. Another part is devoted to the derivation of moments models which require

less computational effort but keep the main properties of the initial models. The second application concerns micro and nanotechnologies, which are expected to play a very important role in the development of MEMS. Since the scale of micro flows is often comparable with the molecular mean free path, it is necessary to adopt the point of view of kinetic theory. Then applications of kinetic theory methods to micro flows are becoming very important and an accurate approximation of the Boltzmann equation is a key issue. Even nowadays a deterministic numerical solution of the Boltzmann equation still represents a challenge for scientific computing. Recently, a new class of algorithms based on spectral techniques in the velocity space has been been developed for the trend to equilibrium. The next important step is to treat applications for MEMS in nanotechnology for which the main difficulty is to treat complex geometries and moving boundary problems.

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**NBR: 239986** **ACRONYM: MINT** **EC FUND: 1782600**

**DG:** ERCEA **Call: ERC-2009-StG** **Thema:** ERC-SG-ID1

**Title:** Multiphoton Ionization Nano-Therapy

**Abstract:** The application of nanotechnology for addressing key problems in clinical diagnosis and therapy holds great promise in medicine and in cancer in particular. Recent works have shown significant progress in nanoparticle-mediated drug delivery and therapy. In these applications, however, the small dimensions of the nanoparticles have been used primarily for efficient delivery and specificity, while the effects mediated by the nanoparticles occur away from the particle itself, affecting the entire cell\tumour volume. We propose to study and develop, for the first time, a novel scheme for cancer therapy that treats cancer cells at nanoscale resolutions. Briefly, when noble-metal nanoparticles are illuminated with femtosecond laser pulses tuned to their plasmonic resonance, order-of-magnitude enhancements of the optical fields several nanometres away from their surfaces lead to local damage only to nearby molecules or cellular organelles. This process, which practically involves no toxic agents, is at the basis for this proposal; we will utilize techniques for targeting nanoparticles to cells, initiate and control cancer cell destruction using nanoparticles and femtosecond laser pulses, and develop technology for conducting image-guided minimally invasive cancer therapy in remote locations of the body. Preliminary results supporting the proposed scheme include nonlinear optical imaging and ablation of living cells, in vivo endoscopic imaging of cancerous tumour nodules, and computer simulations of light-nanoparticle interactions. Using state-of-the-art concepts in nanotechnology, biology, chemistry, and medicine, the proposed novel multidisciplinary research will attempt at offering a feasible and safe addition to existing forms of cancer therapy.

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**NBR: 240076** **ACRONYM: FLATRONICS** **EC FUND: 1799996**

**DG:** ERCEA **Call: ERC-2009-StG** **Thema:** ERC-SG-PE3

**Title:** Electronic devices based on nanolayers

**Abstract:** The main objective of this research proposal is to explore the electrical properties of nanoscale devices and circuits based on nanolayers. Nanolayers cover a wide span of possible electronic properties, ranging from semiconducting to superconducting. The possibility to form electrical circuits by varying their geometry offers rich research and practical opportunities. Together with graphene, nanolayers could form the material library for future nanoelectronics where different materials could be mixed and matched to different functionalities.

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**NBR: 240080** **ACRONYM: NUCLEOPOLY** **EC FUND: 1500000**

**DG:** ERCEA **Call: ERC-2009-StG** **Thema:** ERC-SG-PE5

**Title:** DNA Block Copolymers: New Architectures and Applications

**Abstract:** With our contributions to DNA block copolymers (DBCs), we have opened a new field of interdisciplinary research at the intersection of polymer chemistry, biology and nanoscience. Within this proposal, we intend to apply our expertise with linear DBCs to new nucleocopolymer architectures ranging from star polymers to DNA networks. Our efforts will not only explore new covalently-bonded polymer topologies but also extend the range of self-assembled supramolecular structures accessible with DBCs. Current progress in this direction has yielded spherical and rod-like DBC micelles. In this proposal we further envisage membranes and vesicles generated by macromolecular DNA amphiphiles. A special focus will be the manipulation of the permeability of these structures by hybridization and the insertion of channel proteins. A major part of the proposal addresses potential applications of DBC architectures in the fields of nucleic acid detection and drug delivery. We will produce selective and sensitive nucleic acid probes employing DBCs with highly emissive conjugated polymer segments or based on novel fluorogenic DNA-templated reactions. Plans for potential delivery systems include the establishment of a DBC-based technology platform to allow combinatorial testing of micelle structures equipped with improved targeting, drug loading and stealth functions. For this purpose, the DNA shell of the nanoscopic aggregates will be exploited for its biological activity in the context of antisense and small interfering RNA activity as well as immune stimulation. Finally, we will employ DBC micelles as programmable nanoreactors within the complex environment of living cells and even carry out sequence-specific organic transformations induced by the cell s own messenger RNA

**NBR: 240111** **ACRONYM: NANO-ARCH** **EC FUND: 1299960**

**DG:** ERCEA **Call: ERC-2009-StG** **Thema:** ERC-SG-PE5

**Title:** Assembly of Colloidal Nanocrystals into Unconventional Types of Nanocomposite Architectures with Advanced Properties

**Abstract:** Nanoscience promises innovative solutions in a large variety of sectors, ranging from cost-effective optoelectronic devices to energy generation, and to highly performing materials and interfaces. Realizing this promise will rely heavily on a bottom-up approach. This can only succeed if self assembly of advanced nanoscale building blocks will be developed intensively, to enable creation of useful macroscopic architectures. The unconventional assembly of nanocrystals towards functional materials is the area where this proposal aims at providing a key contribution. This will be achieved via ground-breaking advances in the fabrication of shape controlled nanocrystals, via solution approaches, in their organization following radically new concepts and in the study of their assembly related properties. The bottom line here is to tune the assembly process of nanocrystals so as to generate a desired functionality or a combination of functionalities. This would represent a dramatic leap forward from the trial-and-error approach to controlling the various properties that is currently prevalent in many of the communities working in the field of nanocrystals. The primary motivation of this proposal is therefore to correlate strongly the structural properties with the behaviour of nanostructured assemblies. This is clearly a cutting edge research program, at the frontier of chemistry, physics, materials science and engineering, and whose successful outcome will be of tremendous benefit in several fields.

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**NBR: 240144** **ACRONYM: THREEDSURFACE** **EC FUND: 1398600**

**DG:** ERCEA **Call: ERC-2009-StG** **Thema:** ERC-SG-PE5

**Title:** Three-Dimensional Surface Nano-Patterning: Concepts, Challenges and Applications

**Abstract:** Multifunctional surface nano-patterns on substrates are the foundation of semiconductor nano-devices. There is a major shortcoming of the existing surface nano-patterning techniques - in fact almost all synthesized surface patterns are two-dimensional (2-D) planar structures with low aspect ratio. Thus one of the most attractive advantages of nanomaterials, an extremely large surface area, is missing in the existing 2-D surface nano-patterns. This largely limits the application potential of surface nanostructures on semiconductor devices. In this project, a new concept of three-dimensional (3-D) nano-patterning is proposed. Using this multi-functional 3-D

surface nano-patterning technique, large-scale surface patterns of well-defined one-dimensional (1-D) nanostructures can be synthesized by different fabrication strategies. The realization of the 3-D surface nano-patterning will not only retain the attractive features of the conventional 2-D surface nano-patterning (e.g. high patterning density), but also bring back one of the basic advantages of nanomaterials, i.e. an extremely large surface area. Using an innovative addressing system proposed in this project, it is possible to investigate and analyze the properties of an individual unit within a regular surface nanostructure array and the coupling interaction between the adjacent units. By integrating these data, the properties of the whole ensembles could be obtained. This bottom-up investigation might pave the way to a complete property tuning based on the structural design of surface 1-D nanostructures. The large-scale 1-D surface nano-patterns with well-defined structures have broad application potentials for different high-performance and property-controllable nano-devices.

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**NBR: 240332** **ACRONYM: UFO** **EC FUND: 1773000**

**DG:** ERCEA **Call: ERC-2009-StG** **Thema:** ERC-SG-PE8

**Title:** Uncovering the origins of friction

**Abstract:** Nanotechnology is a new frontier in research and new tools must be developed. As surface to volume ratios become large, engineering at the nanoscale will be dominated by surface science. The study of Contact Mechanics at nanoscales nanotribology- needs to fully account for adhesive forces, third-body interactions and deformation mechanisms at contacting asperities. Understanding these factors as well as the morphological evolution of contact clusters has the potential of explaining the origins of frictional forces and wear. This will guide us in the design of tailored-made lubricants and surface morphologies, which, in turn, will help reduce the high societal cost of wear damage. This ERCstg proposal describes a plan to establish a world-leading group in Contact Mechanics at length scales ranging from the atomic to macroscopic scales relevant to Civil or Mechanical Engineering structural applications. Our approach will have recourse to molecular dynamics coupled with the finite-element method for an accurate description of atomic interactions at the contact surface, and of long-range elastic forces. The project is interdisciplinary as the deepening of our understanding of Contact Mechanics will necessitate Computer Science developments. A central objective of the research will be the release of an open, 3D parallel, finite-element platform dedicated to contact applications. The PI will assemble a team of Engineers and Computer Scientists to ensure a successful and perennial diffusion in the European academic and industrial network. The research will therefore explore the origins of friction, a scientific quest of fundamental importance to many industrial applications, and will also create a stable base for sharing scientific-computing resources.

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**NBR: 240362** **ACRONYM: HEATTRONICS** **EC FUND: 1322371**

**DG:** ERCEA **Call: ERC-2009-StG** **Thema:** ERC-SG-PE3

**Title:** Mesoscopic heattronics: thermal and nonequilibrium effects and fluctuations in nanoelectronics

**Abstract:** Few systems in nature are entirely in equilibrium. Out of equilibrium, there are heat currents, and different degrees of freedom or parts of studied systems may be described by entirely different temperatures if the concept of temperature is at all well defined. In this project we will study the emergence of the subsystem temperatures in different types of small electronic systems, and the physical phenomena associated with those temperatures. Our emphasis is on the mesoscopic effects, residing between the microscopic world of individual atoms and electrons, and the macroscopic everyday world. In particular, we will research thermometry methods, different types of relaxation, magnitudes of fluctuations and effects at high frequencies. We will explore these effects in a wide variety of systems: normal metals and superconductors, carbon nanostructures, nanoelectromechanical and spintronic systems. Besides contributing to the understanding of the fundamental properties of electronic systems, our studies are directly relevant for the development of thermal sensors and electron refrigerators. The improved understanding of the thermal phenomena will also benefit the study of almost any type of a nonlinear phenomenon in electronics, for example the research of solid-state realizations of quantum computing or the race towards quantum limited mass and force detection.

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**NBR: 240382** **ACRONYM: DELPHINS** **EC FUND: 1723206**

**DG:** ERCEA **Call: ERC-2009-StG** **Thema:** ERC-SG-PE7

**Title:** DESIGN AND ELABORATION OFMULTI-PHYSICS INTEGRATED NANOSYSTEMS

**Abstract:** The innovation of DELPHINS application will consist in building a generic multi-sensor design platform for embedded multi-gas-analysis-on-chip, based on a global modelling from the individual NEMS sensors to a global multiphysics NEMS-CMOS VLSI (Very large Scale Integration) system. The latter constitute a new research field with many potential applications such as in medicine (specific diseases recognition) but also in security (toxic and complex air pollutions), in industry (perfumes, agribusiness) and environment control. As an example, several studies in the last 10 years have demonstrated that some specific combination of biomarkers in breath above a given threshold could indicate early stage of diseases. More generally, patterns of breathing gas could constitute a virtual fingerprint of specific pathologies. NEMS (Nano-Electro-Mechanical Systems) based sensor is one of the most promising technologies to get the required

resolutions and sensitivities for few molecules detection. We will focus on the analytical module of the system (sensing part + embedded electronics processing) that will include ultra-dense (more than thousands) NEMS arrays with state-of the art CMOS transistors. We will obtain integrated nano-oscillators individually addressed within an innovative architecture inspired from memory and imaging technologies. Few molecules sensitivity will be achieved thanks to suspended resonant nanowires co-integrated locally with their closed-loop and reading electronics. This would make possible the analysis of complex gases within an integrated portable system, which does not exist yet.

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**NBR: 240387** **ACRONYM: NEMSQED** **EC FUND: 1372999**

**DG:** ERCEA **Call: ERC-2009-StG** **Thema:** ERC-SG-PE3

**Title:** Electromechanical quantum coherent systems

**Abstract:** At a low temperature, nearly macroscopic quantum states can be sustained in superconducting (SC) Josephson junctions. Recently, these superconducting qubits have been coupled to electromagnetic resonators, in a manner analogous to cavity Quantum Electro Dynamics (QED) which describes the interaction between atoms and quantized oscillation modes in the quantum limit. On the other hand, there is yet no experimental evidence of a mode of a mechanical oscillator, such as that of a miniaturized vibrating string, to be chilled down to its quantum ground state. The main part of the proposal involves the use the coupling of Nanomechanical Resonators (NR) to SC qubits employed as artificial atoms in order to address the quantum-classical interface in mechanical motion. Similarly as the SC qubit can exchange quanta with electrical oscillators, it can, in principle, communicate with mechanical modes. The research will begin with demonstrating this kind of electromechanical interaction. In order to tackle experimental surprises, I plan on launching two parallel paths, one with a charge qubit, the other using a phase qubit. The formidable main goal is to experimentally reach the quantum ground state of a mechanical mode. I will investigate the following routes: Make a 1 GHz frequency NR, corresponding to 50 mK, which will reach the ground state at accessible temperatures. On the other hand, I propose to side-band cool a lower-frequency NR via the attached SC qubit. Near the quantum limit, I will start taking advantage of the NR as a building block of electromechanical quantum information. I also propose to push the QED setup of SC qubits coupled to electrical cavities towards more and more complicated states in order to test quantum mechanics in the nearly classical limit.

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**NBR: 240433** **ACRONYM: HI-ONE** **EC FUND: 1750000**

**DG:** ERCEA **Call: ERC-2009-StG** **Thema:** ERC-SG-PE3

**Title:** Hybrid Inorganic-Organic NanoElectronics

**Abstract:** This project aims at combining inorganic and organic materials in hybrid nanoelectronic structures for addressing a set of key problems in solid-state physics: (1) the magnetic ordering of 2D spin systems and their interaction with conduction electrons, (2) the coherent transport properties of organic molecules, and (3) reliable electronic characterization of single nanostructures. For all objectives we will integrate top-down and bottom-up (self-assembly) techniques, benefitting from strong collaborations with leading chemistry groups. For Objective 1, we will apply self-assembled monolayers of organic paramagnetic molecules on various substrates. This geometry offers great tunability for the nature, density and ordering of spins, and for their interaction with underlying electrons. We will study (many-body) phenomena that lie at the very heart of solid-state physics: the Kondo effect, RKKY interaction, spin glasses and the 2D Ising/Heisenberg model, addressing open questions concerning the extension of the Kondo cloud, RKKY-Kondo competition, and the relevance for high-Tc superconductivity. For Objective 2, molecular monolayers are inserted in an electron interferometer, allowing a systematic study of molecular charge coherence. We will study how coherence depends on the molecule s characteristics, such as length and chemical composition. For Objective 3 we will attach single nanostructures (quantum dots) by an innovative self-assembly method to highly-conductive, selectively metallized DNA molecules, bridging the gap between nano and micro. A crucial advantage compared to conventional (top-down) nanocontacting schemes is the high control and reproducibility afforded by sequence-specificity of DNA hybridization, enabling a wide range of fascinating experiments.

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**NBR: 240483** **ACRONYM: KINPOR** **EC FUND: 1150000**

**DG:** ERCEA **Call: ERC-2009-StG** **Thema:** ERC-SG-ID1

**Title:** First principle chemical kinetics in nanoporous materials

**Abstract:** The design of an optimal catalyst for a given process is at the heart of what chemists do, but is in many times more an art than a science. The quest for molecular control of any, either existing or new, production process is one of the great challenges nowadays. The need for accurate rate constants is crucial to fulfil this task. Molecular modelling has become a ubiquitous tool in many fields of science and engineering, but still the calculation of reaction rates in nanoporous materials is hardly performed due to major methodological bottlenecks. The aim of this proposal is the accurate prediction of chemical kinetics of catalytic reactions taking place in nanoporous materials from first principles. Two types of industrially important nanoporous materials are considered: zeotype materials including the standard alumino-silicates but also related alumino-

phosphates and the fairly new Metal-Organic Frameworks (MOFs). New physical models are proposed to determine: (i) accurate reaction barriers that account for long range host/guest interactions and (ii)the preexponential factor within a harmonic and anharmonic description, using cluster and periodic models and by means of static and dynamic approaches. The applications are carefully selected to benchmark the influence of each of the methodological issues on the final reaction rates. For the zeotype materials, reactions taking place during the Methanol-to-Olefin process (MTO) are chosen. A typical MTO catalyst is composed of an inorganic cage with essential organic compounds interacting as a supramolecular catalyst. For the hybrid materials, firstly accurate interaction energies between xylene based isomers and MOF framework, will be determined. The outcome serves as a step-stone for the study of oxidation reactions. This proposal creates perspectives for the design of tailor made catalyst from the molecular level.

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**NBR: 240487** **ACRONYM: PREDMODSIM** **EC FUND: 1462198**

**DG:** ERCEA **Call: ERC-2009-StG** **Thema:** ERC-SG-PE8

**Title:** Predictive models and simulations in nano- and biomolecular mechanics: a multiscale approach

**Abstract:** The predictive ability of current simulations of interesting systems in nano- and biomolecular mechanics is questionable due to (1) uncertainties in material behavior of continuum models, (2) severe limitations of atomistic simulations in the computationally accessible length and time scales in relation with the scales of scientific and technological interest, and (3) the limited understanding gained from terabytes of data produced in supercomputing platforms. These difficulties seriously undermine the credibility of computer simulations, as well as their real impact in scientific and technological endeavors. Examples include fundamental challenges in materials science (structure-property relations), molecular biology (sequence-structure-function of proteins), or product engineering (virtual testing for analysis, optimization, control). This proposal addresses three important topics in nano- and biomolecular mechanics, whose full understanding and technological exploitation require predictive models and simulations: (1) Mechanics of carbon nanotubes at engineering scales, (2) Mechanics of fluid membranes in eukaryotic cells and bio-inspired technologies and (3) Local-to-global conformational space exploration and free energy calculations for biomolecules. We follow a multiscale approach, which seeks to incorporate the net effect of the small-scale phenomena described by fundamental models of physics into the coarser (computable) scales at which the system or device operates. In addition to specific impact in these applications, the proposed research is expected to exemplify the potential of multiscale approaches towards predictive and quantitative science and technology, as well as contribute to the credibility and utility of large investments in supercomputing.

**NBR: 240497** **ACRONYM: NANO-TEC** **EC FUND: 1228000**

**DG:** ERCEA **Call: ERC-2009-StG** **Thema:** ERC-SG-PE8

**Title:** Nano-engineered high performance Thermoelectric Energy Conversion devices

**Abstract:** Providing a sustainable supply of energy to the world s population will become a major societal problem for the 21st century. Thermoelectric materials, whose combination of thermal, electrical, and semiconducting properties, allows them to convert waste heat into electricity, are expected to play an increasingly important role in meeting the energy challenge of the future. Recent work on the theory of thermoelectric devices has led to the expectation that their performance could be enhanced if the diameter of the wires could be reduced to a point where quantum confinement effects increase charge-carrier mobility (thereby increasing the Seebeck coefficient) and reduce thermal conductivity. The predicted net effect of reducing diameters to the order of tens of nanometres would be to increase its efficiency or ZT index by a factor of 3. The objective of this five year proposal is to investigate and optimise the fabrication parameters influencing ZT in order to achieve a power conversion efficiency of >20%. For that, low dimensional nanowires arrays of state of art n and p-type materials will be prepared by cost-effective mass-production electrochemical methods. In order to obtained devices with a ZT >2 for application in energy scavenging and as cooler/heating devices, three approaches will be followed: a) determination of the best materials for each temperature range (n and p type) optimizing composition, microstructure, shapes (core/shell, nanowire surface texture, heterostructures), interfaces and orientations, b) advanced characterization, device development and modeling will be used iteratively during nanostructures and materials optimization, and c) nano-engineering less conventional thermoelectric like cage compounds by electrodeposition methods. This proposal aims to generate a cutting edge project in the thermoelectric field and, if successful, a more efficient way to harness precious, but nowadays wasted energy.

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**NBR: 240500** **ACRONYM: DEDIGROWTH** **EC FUND: 1276038**

**DG:** ERCEA **Call: ERC-2009-StG** **Thema:** ERC-SG-PE5

**Title:** Dedicated growth of novel 1-dimensional materials for emerging nanotechnological applications

**Abstract:** This proposal aims to establish growth systematics for catalytically grown nanomaterials, such as nanoparticles, nanorods, carbon and hetero-atomic nanotubes. At present there is no clear understanding of the formation mechanism of these

structures. Hence, the control over their properties, a vital aspect for technological applications of nanomaterials, is limited and remains difficult. Therefore, the main target of this proposal is the controlled production of new carbon and non-carbon-based nanomaterials with the focus on achieving structural control of the nanomaterials at the atomic level. An essential step towards the controlled generation of such new nanomaterials is a comprehensive understanding of the growth reactions and the role of the metal catalyst involved in the synthesis process. To achieve this, we will use in-situ techniques to study the chemical environment in the reactor during growth and state-of-the-art electron microscopy to reveal the chemical composition of the resulting catalyst particles and structures with atomic resolution. This data will provide information on how the nanostructure may have formed. Theoretical calculations and modelling of atomic scale processes of the catalyst reactivity will be used to draw a consistent picture of the functioning of the catalyst. An improved understanding of the functioning of the catalyst will allow us to estimate how the catalyst particles and reaction conditions have to be modified in order to enhance or to suppress certain products. A new high-throughput synthesis method together with the systematic variation of the growth parameters, such as cluster particle size and composition, temperature, gas pressure and precursor, will be used to generate a nanomaterials growth library. This nanomaterials library will be made available on the Internet for use by other researchers in planning their experiments.

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**NBR: 240544** **ACRONYM: DODECIN** **EC FUND: 1100000**

**DG:** ERCEA **Call: ERC-2009-StG** **Thema:** ERC-SG-PE4

**Title:** Construction of a Molecular Crane Based on the Flavoprotein Dodecin

**Abstract:** The flavoprotein dodecin from the halophilic organism Halobacterium salinarum binds not only native but also artificial flavins with high affinities in their oxidized state. Reduction of the flavins induces the dissociation of the holocomplex into apododecin and free flavin. Based on these unique binding characteristics, a molecular crane shall be developed that is able to pick up and to release molecular objects through a switch of the electric potential. For this purpose, a single flavin has to be linked to the conductive tip of an atomic force microscope via a molecular wire-like subunit (flavin molecular wire AFM tip/electrode). On the basis of such an electrochemically switchable molecular crane, it will be possible to bind and release single molecules of dodecin apoprotein or even larger molecular assemblies attached to apododecin serving as molecular junction. While the construction of a molecular crane for the transport of single molecules is the main goal, the successful realization of this project fundamentally depends on the synthesis and characterization of molecular wire-like subunits, which can be used to attach redox-active proteins to surfaces in an electrochemically switchable state. Thus, functionalized single-walled carbon nanotubes or organic p-electron systems will be examined with respect to their ability to serve as molecular wire. Surface modification

protocols have to be developed and modified surfaces will be investigated by a combination of atomic force microscopy, surface plasmon resonance spectroscopy, and electrochemical methods. The results of these studies will be of general interest for the construction of molecular switches, devices, and transport systems, and for the development of amperometric biosensors and biofuel cells.

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**NBR: 240556** **ACRONYM: MINE** **EC FUND: 1149999**

**DG:** ERCEA **Call: ERC-2009-StG** **Thema:** ERC-SG-PE4

**Title:** Molecular Interfacial structure and dynamics of Nanoscopic droplets in Emulsions (MINE)

**Abstract:** Emulsions consist of one liquid dispersed as nanoscopic droplets in another liquid, such as milk, and butter. The understanding of the structure and stability of emulsions is commonly obtained from empirical studies in which a macroscopic parameter (like temperature or concentration of constituents) is varied. Since the work of Irving Langmuir and others (published in 1917) it is well established that the stability and properties of these nanoscopic droplets are strongly influenced by the state of the droplet interface. However, despite the abundance and importance of emulsions in our daily lives, the molecular mechanisms that dictate the stability and properties of emulsions are still unknown. This lack of insight is caused by the system itself: the condensed surrounding medium forms an impenetrable barrier to most molecular probes. Nonlinear light scattering spectroscopy, a novel method I have developed (both theoretically and experimentally), offers a way of obtaining molecular information (chemical composition, molecular orientation, ordering and chirality) of the interfaces of nanoscopic particles in solution. With this method it should be possible to observe, in-situ, non-invasively and label-free, the molecules at the interface of the nanoscopic droplets in solution. I therefore propose to form a small group that investigates interfaces of nanoscopic droplets in emulsions on the molecular level and timescale. Using femtosecond nonlinear light scattering methods we can finally observe the molecules that dictate the structure and stability of emulsions in action.

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**NBR: 240603** **ACRONYM: ANSR** **EC FUND: 1304800**

**DG:** ERCEA **Call: ERC-2009-StG** **Thema:** ERC-SG-PE2

**Title:** Ab initio approach to nuclear structure and reactions (++)

**Abstract:** Today, much interest in several fields of physics is devoted to the study of small, open quantum systems, whose properties are profoundly affected by the environment; i.e.,

the continuum of decay channels. In nuclear physics, these problems were originally studied in the context of nuclear reactions but their importance has been reestablished with the advent of radioactive-beam physics and the resulting interest in exotic nuclei. In particular, strong theory initiatives in this area of research will be instrumental for the success of the experimental program at the Facility for Antiproton and Ion Research (FAIR) in Germany. In addition, many of the aspects of open quantum systems are also being explored in the rapidly evolving research on ultracold atomic gases, quantum dots, and other nanodevices. A first-principles description of open quantum systems presents a substantial theoretical and computational challenge. However, the current availability of enormous computing power has allowed theorists to make spectacular progress on problems that were previously thought intractable. The importance of computational methods to study quantum many-body systems is stressed in this proposal. Our approach is based on the ab initio no-core shell model (NCSM), which is a well-established theoretical framework aimed originally at an exact description of nuclear structure starting from realistic inter-nucleon forces. A successful completion of this project requires extensions of the NCSM mathematical framework and the development of highly advanced computer codes. The '++' in the project title indicates the interdisciplinary aspects of the present research proposal and the ambition to make a significant impact on connected fields of many-body physics.

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**NBR: 241277** **ACRONYM: SILICON_LIGHT** **EC FUND: 5779519**

**DG:** RTD **Call: FP7-ENERGY-2009-1** **Thema:** ENERGY.2009.2.1.1

**Title:** Improved material quality and light trapping in thin film silicon solar cells

**Abstract:** In this project we will increase the efficiency of thin-film silicon solar cells on flexible substrates by solving the issues linked to material quality, interface properties and light management, thus enabling lower production costs per Watt-peak. The general technological objectives of the project are the development of better materials and enhanced interfaces for thin film silicon solar cells, and to transfer the developed processes to an industrial production line. The most important project goals are: 1) Reduction of optical reflection and parasitic absorption losses: Design and industrial implementation of textured back contacts in flexible thin film silicon solar cells. 2) Reduction of recombination losses: Development and implementation of improved silicon absorber material. 3) Reduction of electric losses: Graded TCO layers which minimize the work function barrier between the p-layer and the TCO layer without loss of conductivity and transmission of the TCO. In addition, the top layer of the TCO stack should provide a good protection against moisture ingression. In order to achieve these objectives more in-depth knowledge is needed for several relevant key areas for thin film silicon solar cells. The main scientific objectives are: 1) Identification of the ideal texture for the back contact. This structure should maximize the light trapping in thin film silicon solar cells without deterioration of open-circuit voltage and fill factor. 2)

Paradigm shift for the growth of microcrystalline silicon. In this project we want to show that it is possible to use microcrystalline silicon with high crystalline fractions leading to better current collection without voltage losses, and without crack formation when grown on nano-textured substrates. 3) Deeper understanding of moisture degradation mechanisms of common TCO's like ITO and AZO.

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**NBR: 241309** **ACRONYM: DEMOYS** **EC FUND: 3442696**

**DG:** RTD **Call: FP7-ENERGY-2009-1** **Thema:** ENERGY.2009.5.1.1

**Title:** Dense membranes for efficient oxygen and hydrogen separation

**Abstract:** Membranes for oxygen and hydrogen separation play a key-role in the development of CO2 emission-free coal or natural gas power plants. In addition, cost-effective oxygen and hydrogen production processes are urgently needed in gas supply industry. Today existing membranes, however, are not able to meet the requirements for an economical use because of the high costs in combination with limited permeability values and long-term stability in the operating environment. The objective of this project is, therefore, the development of thin mixed conducting membranes for O2 and H2 separation by using a new deposition technique "Low Pressure Plasma Spraying – Thin Film" (LPPS-TF) in combination with nanoporous, highly catalytic layers. TF-LPPS is a technique based on a combination of thermal spray and Physical Vapour Deposition technology. It allows the cost-effective production of thin, dense coatings on large areas at low substrate temperatures and has already successfully been used for the deposition of membranes for the solid oxide fuel cells. In this project both ceramic and metallic substrates will be used for deposition. It is expected that, by using the LPPS-TF process a dense, stable deposit with thickness lower than 20 micron can be obtained. This would allow to increase membrane performances while decreasing their manufacturing costs. Catalytic layers will be also applied to enhance the surface reactions becoming rate limiting for thin membranes. Membrane performances will be assessed in pilot loops in order to meet specific targets in terms of permeability and stability at temperature. A modelling study concerning the integration of the developed membranes in power and hydrogen production plants will be also performed. This will provide inputs for process scale-up and cost evaluation in the selected plant configurations in order to approach zero CO2 emission and a CO2 capture cost of 15 €/ton.

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**NBR: 241393** **ACRONYM: ICAP** **EC FUND: 4325202**

**DG:** RTD **Call: FP7-ENERGY-2009-1** **Thema:** ENERGY.2009.5.1.1

**Title:** Innovative CO2 capture

**Abstract:** In post-combustion CO2 capture, a main bottleneck causing significant reduction in power plant efficiency and preventing cost effectiveness is the low flue gas CO2 partial pressure, limiting membrane flux, solvent selection and capacity. In pre-combustion CO2 capture, key bottlenecks are number of processing steps, possible low hydrogen pressure, and high hydrogen fraction in the fuel Global deployment of CO2 capture is restrained by a general need for prior removal of SO2. iCap seeks to remove these barriers by developing new technologies with potential for reducing the current energy penalty to 4-5% points in power plant efficiency, to combine SO2 and CO2 removal, and to reduce the avoidance cost to 15 €/tonne CO2. iCap will: Develop solvents forming CO2 hydrates or two liquid phases enabling drastically increased liquid phase CO2 capacity, radically decreasing solvent circulation rates, introducing a new regime in desorption energy requirement, and allowing CO2 desorption at elevated pressures; Develop combined SO2 and CO2 capture systems increasing dramatically the potential for large scale deployment of CCS in BRIC countries and for retrofit in Europe. Develop high permeability/ high selectivity low temperature polymer membranes, by designing ultra thin composite membranes from a polymeric matrix containing ceramic nano particles. Develop mixed proton-electron conducting dense ceramic-based H2 membranes offering the combined advantages of theoretically infinite selectivity, high mechanical strength and good stability. Develop and evaluate novel coal and gas-based power cycles that allows post-combustion CO2 captures at elevated pressures, thus reducing the separation costs radically. Integrate the improved separation technologies in brownfield and greenfield power plants, and in novel power cycles in order to meet the performance and cost targets of the project

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**NBR: 241405** **ACRONYM: HESCAP** **EC FUND: 2298764**

**DG:** RTD **Call: FP7-ENERGY-2009-1** **Thema:** ENERGY.2009.7.3.2

**Title:** New generation, High Energy and power density SuperCAPacitor based energy storage system

**Abstract:** Energy storage is recognised as a key element for energy networks in the near future. Regarding short-term power delivery and high duty cycle applications, such as stabilization of grids, traction networks and drive-trains of hybrid or full-electric vehicles, it is widely accepted that the use of energy storage systems (ESS) can lead to energy savings. This kind of networks needs ESS capable of storing and releasing energy in the power range from a few hundreds of kW up to 1MW, with a high duty cycle. Dealing with these applications, and among other ESS, supercapacitors (SC) appear as a very promising energy storage technology due to their high power density, high efficiency and very long life cycle. However, it is necessary a step forward in increasing the energy density in order to cover the whole range of specifications and to be fully competitive

regarding to the cost of the stored kW-h, mainly over batteries. The main objective of this project is to develop a new generation high energy supercapacitor based system (HESCAP system), capable of storing ten times more energy than the reported State of the Art SC technology, but keeping the high power density, long life cycle and total capital cost of currently available supercapacitors. This novel approach is based on the recent developments related with the applications of advanced carbide-derive carbons together with nanoparticulate metal oxides in this new generation supercapacitors. Such materials have shown an amazing behaviour not only in terms of intrinsic specific capacitance, but also in their positive effects on the capacitance of conventional carbon electrodes, when they are deposited as nanoporous coatings. The expected impact of the HESCAP system into these stationary or dual-use applications will be a drastic reduction of the volume and weight for a given energy rate, together with a reduction of the cost of the stored kW-h.

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**NBR: 241640** **ACRONYM: SUPRA-BIO** **EC FUND: 12597217**

**DG:** RTD **Call: FP7-2009-BIOREFINERY_CP** **Thema:** ENERGY.2009.3.3.1

**Title:** Sustainable products from economic processing of biomass in highly integrated biorefineries

**Abstract:** Economic and sustainable production of fuels, chemicals and materials from biomass requires capture of the maximum energy and monetary value from sustainable feedstock. SUPRA-BIO achieves this by focussing on innovative research and development of critical unit operations, by using process intensification to match economic production to the scale of available feedstock and by process integration that provides energy from process waste, optimises utilities to minimise environmental impact and maximises value from the product mix. A technology toolbox for conversion and separation operations is developed that adapts to various scenarios of product mix and feedstock. These are contextualized by full life cycle and economic analysis of potential biorefinery schemes. Based on lignocellulose, microbial/organic waste or microalgae feedstock, innovation and intensification are used to improve the economics and carbon efficiency of fractionation, separation, bio and thermochemical conversions to produce biofuels, intermediates and high value products. Strain selection, genetic manipulation, molecular design and nanocatalysis are used to improve productivity and selectivity; reactor design, intensification and utilities integration for economics. Fermentation to 2,3 butanediol is demonstrated. Mono and multiculture processes are researched for high value products and feedstock streams. Separation is developed for omega oils and specific lignochemicals. Nano and biocatalytic processes are developed for biofuels and bioactive molecules. Integration into potential biorefinery schemes is explored in laboratory pilots of integrated reactors, by piloting on sidestreams, by exchanging separated fractions between partners and by process evaluations. The project includes all the scientific, engineering and industrial skills required to produce

the step changes required for biorefineries to impact significantly on realising the aims of the European Strategic Energy Technology Plan

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**NBR: 241683** **ACRONYM: RDCVF** **EC FUND: 2623333**

**DG:** RTD **Call: FP7-HEALTH-2009-single-stage** **Thema:** HEALTH-2009-2.4.4-2

**Title:** Rod-derived Cone Viability Factor

**Abstract:** The discovery of RdCVF (Rod-derived Cone Viability Factor) has provided a clue to understanding the secondary loss of cone photoreceptors (and of central and light-adapted vision) following the degeneration of rod photoreceptors as a consequence of mutations expressed only in rods in most cases of rod-cone degenerations (or retinitis pigmentosa : RP). In two different rodent models of RP, intraocular administration of RdCVF increased significantly cone survival and function. Given the unparalleled genetic heterogeneity of retinal dystrophies, including RP, the delivery of RdCVF appears as a promising, mutation independent strategy for preserving central vision, even at late stages of the disease, opening a wide window for neuroprotection. RdCVF, discovered by team 1, and developed by team 5, has been granted by the EMEA and FDA the Orphan Status. Reaching the stage of phase I/II trials with RdCVF protein therapy in RP implies several key preclinical milestones: 1) the production of GMP grade proteins and their functional validation in in vitro and in vivo assays, 2) pharmacokinetic and pharmacodynamic studies determining, the dosage, half life, site of injection of the protein, while 3) toxicology studies will be performed in normal and mutant mice and rats, and in monkeys. In parallel, based on the knowledge gained by partner 1 on tryparedoxins (the family of RdCVF) and on RdCVF sequence and paralogs, attempts will be made to 4) optimize the therapeutic protein. In order to reduce the injected dose and to provide a steady level of RdCVF, innovative delivery systems such as nanoparticules will be developed. These steps, conducted by renown academic partners in the fields of neuroprotection and toxicology, experienced industrials and subcontractants, will lead to a proof of safety and concept in advanced RP. This may provide a novel, widely applicable approach to an untreatable blinding condition, while hinting towards extension to other neurodegenerative diseases.

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**NBR: 241818** **ACRONYM: NANOANTENNA** **EC FUND: 3999925**

**DG:** RTD **Call: FP7-HEALTH-2009-single-stage** **Thema:** HEALTH-2009-1.2-1

**Title:** Development of a high sensitive and specific nanobiosensor based on surface enhanced vibrational spectroscopy dedicated to the in vitro proteins detection and disease diagnosis

**Abstract:** The main goal of our proposal is to develop a novel optical nanobiosensor based on extraordinary vibrational signal enhancement of the proteins to be detected. To reach vibrational signal enhancement, we will exploit the optical properties of specially designed metallic nanoparticles which should act as nanoantenna and the associated field enhancement to obtain a direct detection of proteins bound to the nanoparticle. Thus, our sensor will reach high sensitivity provided by the recently established large enhancement of vibration signals due to the resonant excitation of the nanoantenna device used as substrates. The aim is to detect only a few proteins with concentration much lower than 1pM and finally to reach detection threshold such as femtomole or lower. High molecular selectivity will be reached with the functionalisation of the nanoantenna. Such functionalisation will selectively favour the immobilisation of the protein to be detected at the vicinity of the nanoparticle surface, providing the best enhancement and then the detection of the targeted protein. Our nanobiosensor will include two main components: the nanoantenna device which corresponds to our sensor transducer and the functionalisation which corresponds to its bioreceptor. And then, each functionalised nanoantenna device used as vibrational signal enhanced system is an individual and specific nanosensor of proteins. As a consequence, our nanobiosensor integrated in a vibrational spectroscope will allow the detection and the analysis of the enhanced vibrational signal from the targeted proteins and thus corresponds to our diagnosis instrument. Our nanobiosensor will be validated on the detection of proteins on body fluids.These proteins have been chosen since they have been identified as specific biomarkers of common pathologies. This validation will be applied it to improve their detection (better sensitivity, decrease of the detection threshold) and open the way to the early diagnosis.

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**NBR: 242098** **ACRONYM: LUPAS** **EC FUND: 4978094**

**DG:** RTD **Call: FP7-HEALTH-2009-single-stage** **Thema:** HEALTH-2009-1.2-5

**Title:** Luminescent polymers for in vivo imaging of amyloid signatures

**Abstract:** In this project we seek to develop new smart imaging molecular tools for combating neurodegenerative diseases such as Alzheimer's disease and prion diseases. Emphasis is put on translational applied research for the development and validation of novel properly functionalized luminescent conjugated polymers (LCP) that via modern imaging technology can give rise to entirely new and innovative methodology for studying neurodegenerative diseases. The objectives include the development of novel imaging agents that can be utilized for biomedical research, diagnosis, monitoring and prognosis, and for support and guidance of therapeutic interventions for Alzheimer's disease and

prion diseases. The consortium is composed of expert groups in experimental optics, polymer synthesis, magnetic resonance imaging (MRI), synthesis of functionalized magnetic nanoparticles, amyloid structure, AD mouse models, clinical AD, and prion diseases. At the same time this project establishes strategic links between mainly SME based Industries, expert researchers at universities and principal users in terms of hospitals. The project consortium will develop and share an efficient plan for dissemination and exploitation of the project results.

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**NBR: 242264** **ACRONYM: NANOGNOSTICS** **EC FUND: 4037064**

**DG:** RTD **Call: FP7-HEALTH-2009-single-stage** **Thema:** HEALTH-2009-1.2-1

**Title:** Quantum Dot-Based Highly Sensitive Immunoassays for Multiplexed Diagnostics of Alzheimer's Disease

**Abstract:** 6.1 million people currently live with a form of dementia in the European Union with an addition of 1.4 million new cases every year. Combination of psychological testing, brain-imaging and exclusion of other neurological disorders makes the diagnosis of Alzheimer's disease complicated and time consuming (taking up to 20 months). A rapid, sensitive and specific immunoassay for protein markers inside blood would largely improve early diagnosis and lead to a better treatment of dementia. Homogeneous assays based on FRET from one dye labeled specific antibody (AB1) to another (AB2) within an "AB1-biomarker-AB2" immune complex are an ideal basis to meet these diagnostic requirements. As the detection of several protein markers is obligatory for a highly sensitive and specific diagnosis an optical multiplexing approach with dyes of different colors is a smart solution. Semiconductor quantum dots (QDs) are the ideal candidates due to their size-dependent absorption and emission wavelengths. Moreover, they possess unique photophysical properties that overcome conventional fluorescence dyes. In combination with lanthanide complexes (LCs), that display long luminescence lifetimes and well separated emission bands, QDs render a powerful multiplexing tool for highly sensitive diagnostics even for large immune complexes. FRET applications using QDs are to date restricted to academic research and a profound understanding of QD-based FRET is not available. For a comprehensive analysis the use of LCs is mandatory, because they are the only known donors for efficient FRET to QD acceptors. NANOGNOSTICS strives for a profound understanding of QD-based FRET, the synthetic creation of highly efficient QD immune sensors for detection of several Alzheimer-specific protein markers and the development of a modular high-throughput-screening immuno analyzer for the integration of QD-based multiplexing immunoassays into early diagnosis for improved patient outcome in dementia therapy.

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**NBR: 242309** **ACRONYM: DIRAC** **EC FUND: 2987717**

**DG:** REA **Call: FP7-SEC-2009-1** **Thema:** SEC-2009-1.3-02

**Title:** rapid screening and identification of illegal Drugs by IR Absorption spectroscopy and gas Chromatography

**Abstract:** The goal of this project is to develop an advanced sensor system, that combines miniaturized Gas Chromatography (GC) as its key chemical separation tool, and Hollow-Fiber-based Infra Red Absorption Spectroscopy (HF-IRAS) as its key analytical tool to recognize and detect illicit drugs, key precursors and potential derivatives. The DIRAC sensor will be developed to: 1) be used on the field primarily by customs officers for controls at the EU external frontiers and by law enforcement personnel for intra-Community checks as a rugged and hand-portable unit; 2) perform rapid detection of key chemicals; 3) reject interferents with minimal false positive alarm rate; 4) perform advanced data analyses such as similarity evaluation between the chemical structure of the unknown sample with that of controlled/illicit substances. Currently, GC-IRAS (through FTIR implementation) is, together with GC-MS (Mass Spectrometry), the most powerful technique for the identification and quantification of amphetamines. However, so far GC-IRAS has been implemented only as bench-top instrumentation for forensic applications and bulk analysis down to milli- and micro-gram quantities. In DIRAC, the use of silicon-micromachined GC columns, solid state lasers, and hollow fibres IR, will allow to develop a GC-IRAS sensor that features hand-portability and prompt response – for field operation– and is capable to perform both bulk analysis and trace analysis with nano-gram sensitivity. The DIRAC sensor will further feature a) an advanced sampling device, that separates the analyte from larger amounts of interfering materials (dust, skin particles) by electrostatic charging; and, b), an advanced silicon micro-machined pre-concentration device, capable to treat sequentially both volatile ATS substances and non volatile ammonium salts of the amphetamines. The main output of the DIRAC project will be a fully functional sensor prototype from sampling to read out.

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**NBR: 242933** **ACRONYM: NANOTRANS** **EC FUND: 1956000**

**DG:** ERCEA **Call: ERC-2009-StG** **Thema:** ERC-SG-LS3

**Title:** Biomolecular Motor Systems: From Cellular Function to Nanotechnological Applications

**Abstract:** This interdisciplinary project aims (i) to understand intracellular transport processes on a molecular level using novel nano-optical imaging tools and (ii) to use the insight from cellular systems to operate biomolecular motor systems in engineered environments for the fulfillment of complex nanotechnological tasks. Building on experience in optical microscopy and single molecule biophysics the research group will develop and apply nanotechnology-based tools to study the dynamical functioning of microtubule-based motor proteins in vitro and in vivo with nanometer resolution in three dimensions.

These studies are expected to broaden the general knowledge about the design principles of molecular machines as well as the principles by which they interact with each other. This knowledge will - in return - pave the road for applications of these highly evolved transport machineries for a wide range of self-organizing nanofunctions in engineered environments. In contrast to conventional "macroscopic" top-down or "atomic" bottom-up approaches, a driving factor for this research is the capability of cellular machines to work in parallel, thus enabling the efficient fabrication and detection of nanostructures. The project will be strongly focussing on the interface between molecular cell biology and nanotechnology. With respect to the applied ERC funding, the project goals can be described by: Goal 1: Single-molecule studies on motor proteins using optical 3D-nanometer imaging, Goal 2: Investigation of cooperative effects in multi-motor transport, Goal 3: External control over transport systems in engineered environments, and Goal 4: Application of motor systems for nano-manipulation and nano-detection. Regarding the long-term goal, it is envisioned to let smart nanomaterials fulfill biological functions in cellular systems and to efficiently operate biomolecular machines in engineered environments.

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**NBR: 242991** **ACRONYM: OPTIMISE** **EC FUND: 1616146**

**DG:** ERCEA **Call: ERC-2009-StG** **Thema:** ERC-SG-LS7

**Title:** Optical Platform for Therapy and diagnostic Imaging in Minimally Invasive Surgical Endoscopy

**Abstract:** With the clinical drive for earlier detection of disease and minimally invasive treatment, there is a paradigm shift of imaging and therapy towards in vivo, in situ surgery. One major effort towards this goal is the translation of emerging optical diagnostic imaging and therapy techniques into minimally invasive surgery (MIS) and cancer screening. This proposal will develop a novel multimodal platform that can be deployed in flexible endoscopy and robotic assisted MIS devices. This is timely in that recently there have been advances in the optical detection of diseased tissue states and also in nanotechnology that allows photothermal therapies based on focused optical energy delivery to gold nanoparticles. The clinical integration of these two strands of research offers significant promise for optical adjuvant cancer therapies and for image-guided tissue fusion, but the study of the therapeutic effect of these techniques has been limited due to the lack of a common platform for image-guided optical follow-up of the therapy. The purpose of this proposal is to develop a programmable light source for simultaneous multimodal screening and image-guided nanoparticle-mediated thermal therapy. The platform will be validated by studying of diseases of the colon to enable detection and treatment of flat polyps that may develop into invasive cancers. As a young lecturer, Dr Elson has extensive multidisciplinary experience in laser technology, biophotonics, optical imaging, microscope technique development, minimally invasive surgery and robotic-assisted surgery. He will bring together new technology with a mix

of engineering, biochemistry and biophotonics skills. The proposed work will be carried out in state-of-the-art facilities with access to the clinic for translation.

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**NBR: 243047** **ACRONYM: INCEL** **EC FUND: 1294000**

**DG:** ERCEA **Call: ERC-2009-StG** **Thema:** ERC-SG-LS1

**Title:** Revealing the molecular architecture of integrin mediated cell adhesion

**Abstract:** Cell adhesions play an important role in the organization, growth, maturation, and function of living cells. Interaction of cells with the extracellular matrix (ECM) plays an essential role in a variety of disease states , inflammation, and repair of damaged tissues. At the cellular level, many of the biological responses to external stimuli originate at adhesion loci, such as focal adhesions (FA), which link cells to the ECM . Cell adhesion is mediated by receptor proteins such as cadherins and integrins. The precise molecular composition, dynamics and signalling activity of these adhesion assemblies determine the specificity of adhesion-induced signals and their effects on the cell. However, characterization of the molecular architecture of FAs is highly challenging, and it thus remains unclear how these molecules function together, how they are recruited to the adhesion site, how they are turned over, and how they function in vivo. In this project, I aim to conduct an interdisciplinary study that will provide a quantum step forward in the understanding of the functional organization of FAs. We will analyze, for the first time, the three-dimensional structure of FAs in wild-type cells and in cells deficient in the specific proteins involved in the cell-adhesion machinery. We will study the effect of specific geometries on the functional architecture of focal adhesions in 3D. A combination of state-of-the-art technologies, such cryo-electron tomography of intact cells, gold cluster chemistry for in situ labeling, and modulation of the underlying matrix using micro- and nano-patterned adhesive surfaces, together with correlative light, atomic force and electron microscopy, will provide a hybrid approach for dissecting out the complex process of cell adhesion.In summary, this project addresses the properties of FAs across a wide range of complexities and dimensions, from macroscopic cellular phenomena to the physical nature of these molecular assemblies

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**NBR: 243093** **ACRONYM: JTOMO** **EC FUND: 1724400**

**DG:** ERCEA **Call: ERC-2009-StG** **Thema:** ERC-SG-LS1

**Title:** Study of the molecular organization of cell junctions by cryo-electron tomography

**Abstract:** Cells sense, affect and respond to their environment through the fundamental function of adhesion. Several types of adhesion sites, which are mediated via dynamically

maintained multi-protein structures, anchor extracellular-matrix proteins to the cytoskeleton. Despite considerable efforts, the long-standing questions of how adhesion sites are formed, structured and regulated remain unanswered. In this research plan we will investigate desmosomes and adherens junctions by cryo-electron tomography of cells and tissue. The principal objectives are: (a) to visualize the molecular architecture and reveal the structural differences of the adhesion sites under various conditions and influences, i.e. mutations, wounds, etc. (b) to reveal their molecular association to the cytoskeleton (intermediate and actin filaments respectively), and to chart the network of interactions underlying cellular adhesion, and (c) to develop novel pattern recognition and classification techniques in order to structurally characterize the adhesion sites in toto by cryo-electron tomography of vitreous sections. We will use pattern recognition techniques and locally averaged cryo-electron sub-tomograms to quantify the macromolecular complexes in terms of stoichiometry and protein interactions in situ at high resolution (~3 nm). In particular, we aim to reveal how a pool of constituent proteins is organized in the two adhesion sites. Significant amounts of information coming from immunogold electron microscopy, fragments from X-ray structures, force measurements with atomic force microscopy, and structural bioinformatics will be integrated into our cryo-electron tomograms. This research will pioneer structural comparisons of protein networks at nanometer resolution in situ and in toto. The experimental and theoretical methods that will be developed would be indispensable for studying any spatially constrained protein network whose state depends on local properties.

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**NBR: 243261** **ACRONYM: SCINSCEF** **EC FUND: 1759613**

**DG:** ERCEA **Call: ERC-2009-StG** **Thema:** ERC-SG-LS7

**Title:** Repair Spinal Cord Injury by Controlling Migration of Neural Stem Cells - multidiciplinary approaches of electric stimulation and nanotechnology

**Abstract:** Millions of people worldwide suffer from spinal cord injury (SCI), with devastating consequences and costs. Various clinical approaches have been attempted to treat SCI with little satisfaction due to the limitation of self-regeneration of axons. Neural stem cell transplantation is an alternative approach with great potential to treat SCI, but the mechanisms controlling migration of implanted stem cells are unclear. A recent SCI clinical trial using implanted electric stimulators to promote axon regeneration showed promising results. However, the mechanism underpinning this technique also remains elusive. We shall investigate genes and molecules regulating the electric fields controlled neural stem cells migration. We have shown before that electric signals play essential roles in directing cell migration during wound healing, and that PI3K and PTEN are critical in the regulation of this event (Zhao, Song et al. Nature 2006). Pax6 and ephrin are also proved to be important in guiding cell migration, however the interactions between PI3K, PTEN and Pax6, Eph-ephrin pathways are unknown. We shall further

investigate their potential interactions in this project.. Apart from electric signals, neural stem cell migration can be also regulated by chemical, physical, and haptotactic guidance cues. This project shall use multidisciplinary approaches to combine neural stem cells transplantation with electric stimulation and nanotechnology, to optimize a novel stem cell replacement therapy. We shall use multiple peptide structures to engineer diverse adhesion peptide motifs on the nanofibers, and embed EGF/bFGF into 3D nanofibers scaffold to encapsulate neural stem cells for the transplantation study. These shall be tested in both 2D / 3D in vitro and in SCI animal models in vivo.

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**NBR: 243296** **ACRONYM: TRANSLATIONMACHINERY** **EC FUND: 1690000**

**DG:** ERCEA **Call: ERC-2009-StG** **Thema:** ERC-SG-LS1

**Title:** Integrative structure and function study of the bacterial and human protein synthesis machinery.

**Abstract:** The aim of the project is to understand key steps in the molecular mechanisms of protein synthesis across species. The structure and function of pro- and eukaryotic (including human) ribosomes, those cellular nano-machineries that catalyse the decoding of genes, will be studied through an integrative, interdisciplinary structural biology approach. Since in the cell the ribosome is regulated by transiently binding protein and RNA factors, we plan the reconstitution and structural investigation of ribosome complexes in functionally defined states with regulatory proteins and messenger RNAs (mRNA). Four work packages will form the basis of the investigation, (i) the role of mRNA structure in gene expression in pro- and eukaryotes, (ii) the mechanism of translation initiation in prokaryotes as important antibiotic targets, (iii) the high-resolution structure of the human ribosome, and (iv) the architecture of eukaryotic polysomes, the functional protein synthesis entities of living cells. The complexes will be studied using a comprehensive approach which will incorporate biochemistry, structural biology, biophysics and bio-informatics, with cryo-electron microscopy and X-ray crystallography forming the core. The dynamic aspects of the protein synthesis machinery such as structural and functional transitions will be investigated by separation of multiple states through advanced image processing procedures, molecular dynamics simulations and by exploring new developments in optical imaging. Collaborations with leading laboratories have been set up in order to create an efficient framework for which the host institute provides an outstanding infrastructure. The project will provide fundamental knowledge on the mechanism of gene expression regulation at the level of protein synthesis contributing in the long term to the development of new drugs.

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**NBR: 243421** **ACRONYM: ARTIST** **EC FUND: 1999248**

**DG:** CNECT **Call: FP7-ICT-2009-C** **Thema:** ICT-2007.8.0

**Title:** Alternative Routes Towards Information Storage and Transport at the Atomic and Molecular Scale

**Abstract:** The ARTIST project aims at exploring alternative routes towards long distance (above 10 nm) information transport and storage at the atomic and molecular scale. ARTIST suggests new solutions for optical and electrical addressing of molecules, efficient inter-molecular communication and compatible data storage. We will implement new concepts and methods for molecular electronics based on: Addressing by: nanoscale plasmonic waveguides, electrostatics and single charge injection by weak coupling to nanocapacitors. Long distance information transport by: (i) intramolecular single electron transfer in long molecular ribbons made in situ by on-surface chemistry from precursor molecules, (ii) intermolecular propagation of proton transfer in self-assembled chains of tautomers and (iii) plasmon-mediated energy transfer. Information storage by: (i) charge trapping in atoms and molecules, (ii) conformation change and (iii) tautomerization of single molecules. The proposed devices will ensure operation time on the picosecond scale, sub-nanometer wire diameters and construction by self-assembly or on-surface chemistry. The ARTIST project is made possible by a multidisciplinary collaboration of experts in: (i) covalent and hydrogen-bonded self-assembled molecular ribbons, (ii) imaging and manipulation of molecules on thin insulating films, bulk insulators and wide band-gap semi-conductors with atomic-scale precision, (iii) nano-scale optical addressing (iv) measurements at the single molecule and electron level. (v) nanoscale fabrication using nanostencil and (vi) theory and simulation of adsorbed molecules and tunnelling A successful achievement of the project goals will open the way to a completely new nano-scale technology for information processing and storage. The ARTIST project has a clear long term potential for fabrication of reliable large arrays of molecular electronic devices.

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**NBR: 243557** **ACRONYM: CLIP** **EC FUND: 2691790**

**DG:** REA **Call: FP7-SME-2008-2** **Thema:** SME-2

**Title:** Enhancing Printed Electronics Applications by SMEs

**Abstract:** The project will focus on three development aims: 1) development, formulation and feasibility assessment of several lower-cost alternatives for Silver nanoparticle based conductive inks 2) for these lower-cost inks finding alternatives for conventional screen printing, which allow digital printing combined with high resolution printing and enable contactless printing, which improves quality and reliability of circuits 3) demonstration of system concepts for Printed Electronics in two different application domains: a. Printing of smart packaging tags and labels, specifically for pharmaceutical applications

b. High speed low cost antennas for contactless cards and RFID tags Main impact on SMEs will be: • Allow SMEs to access extensive new markets and customers with large potential for revenue generation • Allow SMEs to surplus their current products or product offering with remarkable, new, high-valued features that will increase (perceived) product value • Provide SMEs with the information, (partnering) contacts and tools to make the transition • Identify the costs/impacts involved to allow SMEs to make an informed decision.

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**NBR: 243574** **ACRONYM: STEELPROST** **EC FUND: 1871649**

**DG:** REA **Call: FP7-SME-2008-2** **Thema:** SME-2

**Title:** INNOVATIVE FIRE PROTECTIVE COATINGS FOR STEEL STRUCTURES

**Abstract:** Current methods to provide fire protection of light steel structures include the nowadays most efficient approach of intumescent paints, which are typically applied on-site on a mounted structure using brushes or spray guns. Such treatments are generally achieved through the preparation of the surface by grit/shot blasting, followed by the application of a primer, and followed by the application of several layers of intumescent coatings. This methodology has a number of drawbacks for a large community of end users, including: a)Drying times of intumescent coatings are very long, resulting in high cost associated to labour, site disruption, and space required for painting; b) As a consequence of those significant costs and burdens, the reality is that many end users, particularly SMEs, end up applying fewer layers than required, uneven or irregular layers, or none at all, breaching therefore current legislation, facing serious penalties and fees and endangering the security of their own installations. The STEELPROST project aims to provide a solution to current surface treatment limitations, by developing a second generation of fire-protective coatings that are: easier to paint on, covering a larger area faster, having improved adhesion and quick drying properties. This will be achieved through 3 core innovations: 1)Development of low cost fire-retardant agents using novel tin-based technology, based on nontoxic halogen-free additives ; 2)Combination of the above fire retardant agents with further nanoparticle additives to confer the paint outstanding adhesion to the metal, and increase abrasion and wear resistance properties; 3)Design and optimisation of a procedure for fast curing of the coating using existing heating source technologies such as infra-red (IR). The proposed technology is expected to reduce steelwork treatment cost in constructional projects on a 25% for on-site applications and 50% for off-site application.

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**NBR: 243725** **ACRONYM: NANOFLEX** **EC FUND: 2529667**

**DG:** REA **Call: FP7-SME-2008-2** **Thema:** SME-2

**Title:** An Universal Flexible Low-cost Plumbing and Heating pipe system fully Environment-compatible by using innovative Nanoparticle technology

**Abstract:** The building and construction community in Europe includes about 150000 plumbing, heating, ventilation, air conditioning contractor SMEs with 1.2 million employees generating a total turnover of €130Bn. Our community faces the challenges of meeting the growing demand for plastic pipes and the EU Landfill Directive and the revised EU Waste Framework Directive. The polluter-pays principle says that the costs of waste management are to be borne partly or wholly by the producer of the product from which the waste came and the distributors of such products, who are our SME members. Under floor heating, radiator heating and plumbing systems accounting in total 1.7 million kilometres of new piping in Europe, of which 56%, namely 0.96 million km are plastic pipes. 46% of these plastic pipes are made of PEX, which due to its cross-linked nature is not recyclable. Recycling of multilayer pipes with encapsulated aluminium results in highly toxic by-products. About 3500 tonnes of scrap plastic pipes is disposed of in land fill due to the use of non-recyclable plastics. Our idea is the development of a universal flexible plastic pipe system suitable for under floor heating, radiator heating and drinking water distribution. We propose to develop a pipe without PEX, and without an integral aluminium layer to allow 100% of the pipe scrap to be recycled. We will achieve this by replacing aluminium or expensive EVOH oxygen barrier materials with innovative nanocomposites in combination with a redefined wrapping technology. The plumbing and heating contractors will benefit from selling a new innovative fully environment-compatible universal pipe system providing: savings in costs for storage, transportation, and logistics; improved work facilities (easy to install and bend); waste cost savings and CO2 emission savings. The project is expected to generate over €98 million in Europe within 5-year post-project time, including exports up to €300 million and creating an estimated 2000 jobs

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**NBR: 243813** **ACRONYM: ECO-GRAPHENE** **EC FUND: 45000**

**DG:** REA **Call: FP7-PEOPLE-2009-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Electronic correlation in pristine and doped graphene layers

**Abstract:** Since the discovery of two–dimensional and meta–stable graphene sheets, the recent years have witnessed a dramatic increase in the research dedicated to explore its physical properties. This can be attributed to the two following reasons. First, graphene allows one to address basic questions of quantum mechanics such as relativistic Dirac fermions or the Klein paradoxon in a simple condensed–matter experiment. Second, the nanometer size, the scalability and room–temperature ballistic transport properties make graphene a promising candidate for future nanoelectronic devices with high

electronic mobilities and an ideal material for spintronics. In this proposal, the spectroscopic investigation of functionalized mono– and few–layered graphene (FLG) is suggested. The samples are already available as graphene layers grown by precipitation on SiC and by chemical vapour deposition on metal (111) surfaces and as graphite intercalation compounds (GICs), consisting of stacked layers of doped graphene sheets. Their electronic, vibronic and optical properties as a function of functionalization will be investigated by optical spectroscopies, photoemission and electron energy loss. We utilize a combined experimental and theoretical approach in order to gain a deep understanding of graphene physics. Particular emphasis will be paid to electronic correlation effects and how they contribute to the recently discovered exotic properties of graphene. Our multi-disciplinary approach ensures that the results obtained will not only contribute to the fundamental understanding of correlation effects but also yield valuable input for device physics of graphene.

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**NBR: 243845** **ACRONYM: ROOTHZ** **EC FUND: 1567109**

**DG:** CNECT **Call: FP7-ICT-2009-C** **Thema:** ICT-2007.8.0

**Title:** Semiconductor Nanodevices for Room temperature THz Emission and Detection

**Abstract:** ROOTHz project addresses the bottleneck of Terahertz Science and Technology, where the fabrica-tion of room temperature, continuous wave, compact, tunable and powerful sources (at low cost, if possible) is the prime challenge. THz radiation (also called T-rays), whose frequency range lies between microwaves and infrared light in the electromagnetic spectrum, opens the possibility for a new imaging and spectroscopic technology with a broad range of applications, from medical diagnostic (without the damage pro-duced by ionizing radiation such as X-rays), industrial quality control or security-screening tools. T rays sources must be obtained at the limits of electronics from one side and optical systems from the other, resulting in a lack of efficient and practical radiation sources. In ROOTHz we propose to exploit THz Gunn oscillations in novel (narrow and wide bandgap) semiconductor nanodevices, which have been predicted by simulations but not experimentally confirmed yet. We aim at the fabrication not only of solid state emitters but also detectors at THz frequencies by exploiting the properties of both wide and narrow bandgap semiconductors and the advantages pro-vided by the use of novel device architectures such as slot-diodes and rectifying nano diodes (nano-channels with broken symmetry so called self-switching diodes, SSDs). The simplicity of the tech-nological process used for the fabrication of these diodes is remarkable, since it only involves the etching of insulating trenches or recess lines on a semiconductor surface (a single step of high reso-lution lithography). Furthermore, their particular geometry allows providing Gunn oscillations overcoming the classical frequency limit (around 300GHz). The fabrication of THz detectors with the same technology will complement this objective and allow the demonstration of a simple THz detection/emission subsystem at the conclusion of the project.

**NBR: 244123** **ACRONYM: NIKER** **EC FUND: 2736114**

**DG:** RTD **Call: FP7-ENV-2009-1** **Thema:** ENV.2009.3.2.1.1

**Title:** NEW INTEGRATED KNOWLEDGE BASED APPROACHES TO THE PROTECTION OF CULTURAL HERITAGE FROM EARTHQUAKE-INDUCED RISK

**Abstract:** The project tackles the problem of earthquake-impact on Cultural Heritage assets starting from basic consideration that efficient protection, with substantial guarantee of compatibility and low-intrusivity, can only be achieved with 'minimum intervention' approach. This requires that potentialities of existing materials and components are as much as possible exploited in terms of strength and energy dissipation, and candidate interventions are validated and optimized on specific, real application conditions. At the project start, earthquake-induced failure mechanisms, construction types and materials, intervention and assessment techniques will be cross-correlated with the aim of developing new integrated methodologies with a systemic approach. Traditional materials will be enhanced by innovative industrial processes (e.g., nano-limes or micro-silica for injection), and new high-performance (e.g. dissipative) elements will be developed. Novel collaborative combinations of them will be tested on structural components (walls, pillars, floors, vaults) and on structural connections (wall-, floor- and roof-to-wall), which converge the behaviour of single strengthened elements into the global structural response. The envisaged techniques will be also validated on model buildings and substructures. Advanced numerical studies will allow parameterizing the results and deriving simple and optimized design procedures. Early warning techniques for intelligent interventions and advanced monitoring techniques for knowledge based assessment and progressive implementation of interventions will be also developed. This bottom-up approach will bring to new integrated materials, technologies and tools for systemic improvement of seismic behaviour of CH assets. The new solutions will be condensed into guidelines for end-users. The large participation of research centres, SME, and end-user from various countries, including ICPC and MPC, ensures increased impact of the research.

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**NBR: 244264** **ACRONYM: PERARES** **EC FUND: 2728041**

**DG:** RTD **Call: FP7-SCIENCE-IN-SOCIETY-2009-1** **Thema:** SiS-2009-1.2.1.1

**Title:** Public Engagement with Research and Research Engagement with Society

**Abstract:** PERARES strengthens public engagement in research (PER) by developing multi-annual action plans, involving researchers and Civil Society Organisations (CSOs) in the

formulation of research agendas and the research process. It uses debates on science to actively articulate research requests of civil society. These are forwarded to research institutes, and results are used in a next phase of the debate. Thus, these debates move 'upstream' into agenda setting. For this, partners link existing debate formats with the science shop network – already linking civil society and research institutes - and start a transnational web portal for debates. This is piloted on nanotechnology, then every few months a new debate starts. These are connected to the European reflection on the grand societal challenges for the future of the ERA. To be able to answer to research requests, it is necessary to enlarge and strengthen the network of research bodies doing research for/with CSOs. Thus, nine new science shop like facilities throughout Europe are started, mentored by experienced partners. Science shop-like work is advanced by adding studies on good practices to the available knowledge base and organising workshops. Guidelines to evaluate the impact of engagement activities are developed and tested. The partners pilot and assess alternative forms of agenda-setting dialogue between researchers and CSOs, e.g. long-term periodic meetings, and direct co-operations in two important social sciences fields: Roma/Traveller's issues and domestic violence issues. The partners also investigate the potential role of higher education institutes and funding councils in supporting co-operation with CSOs. PERARES discusses its activities with the wider community through two large conferences and ongoing dissemination. Thus, through increased, better structured co-operation, more researchers and CSOs engage in incorporating needs, concerns and knowledge of civil society in research agendas.

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**NBR: 244405** **ACRONYM: BIOMONAR** **EC FUND: 2997486**

**DG:** RTD **Call: FP7-KBBE-2009-3** **Thema:** KBBE-2009-3-6-03

**Title:** Biosensor nanoarrays for environmental monitoring

**Abstract:** BIOMONAR develops multiplexed nanoarray biosensors for environmental targets, i.e. pollutants and pathogens. The innovative approach engineers three sensor platforms (surface, liposomal, living cell) which exploit a panel of periplasmic binding proteins (PBPs) as the common selective element. The nanoarrays are integrated into a microfluidics system for in-situ monitoring. The strategy allows for selective and sensitive detection of target compounds in complex environmental mixtures. The sensor platforms probe different aspects in the 'exposure to effect' chain of processes: each responds to a certain proportion of the total target concentration and has a characteristic dynamic window. The sensor signals are quantitatively interpreted and represented in terms of the spectra of reactivities and fluxes of the target compounds. This level of sophistication, coupled with the common PBP selective component, allows a coherent elucidation of the link between dynamic target speciation and predicted ecotoxicological impact. The optimisation and dedication of the sensors for environmental monitoring inherently involves physicochemical characterisation of the

various bio/nonbio and bio/bio interfacial processes at nanoscale. The ensuing knowledge on the interaction of nanostructured surfaces with biological systems facilitates design of sensors for new targets, thus providing technical opportunities for the biosensor industry.

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**NBR: 244541** **ACRONYM: PRACTIS** **EC FUND: 988456**

**DG:** RTD **Call: FP7-SCIENCE-IN-SOCIETY-2009-1** **Thema:** SiS-2009-1.1.2.1

**Title:** Privacy - Appraising Challenges to Technologies and Ethics

**Abstract:** The vision that motivates PRACTIS is of a society that is aware of the evolving challenges to privacy posed by emerging technologies and is equipped to respond to them. PRACTIS will assess the potential impacts on privacy from emerging technologies and new scientific knowledge. It will propose ethical frameworks and legal procedures for coping with potential risks to privacy. It will explore novel policy options for addressing individuals' changing privacy needs in the light of new technologies, as well as exploring new ethical frameworks in law and implementing guidelines for new technology or product development. Specifically, long-range horizon scanning focused on technologies that might impact on privacy will be conducted. Technologies such as nano, bio, info and cognition (NBIC) will be explored and new threats to privacy will be evaluated. In addition, trends in changing perceptions of privacy will be surveyed (including among high school students). These empirical studies will provide the basis for future scenarios of the privacy-technology interface which in turn will lead to the formulation of new ethical frameworks and legal considerations. Research methods will include interviews, expert surveys, focus groups, and brainstorming. PRACTIS will generate deeper knowledge and higher awareness among scholars and relevant stakeholders regarding the early identification of changes in privacy perceptions due to new technologies. An innovative idea to be explored in PRACTIS is the embedding of privacy issues in the development process of new technologies. By bringing leading experts in technology foresight and assessment together with specialists in ethical and legal aspects of privacy, PRACTIS offers a unique combination of disciplines that will produce new knowledge on the relationship between technology, privacy and ethics. Implications of the findings will be derived for policymakers, scholars, standardisation bodies and other stakeholders.

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**NBR: 244967** **ACRONYM: MEM-S** **EC FUND: 2816819**

**DG:** RTD **Call: FP7-KBBE-2009-3** **Thema:** KBBE-2009-3-6-02

**Title:** Bottom-up design and fabrication of industrial bio-inorganic nano-porous membranes with novel functionalities based on principles of protein self-assembly and biomineralization

**Abstract:** There is strong interest in the development of novel functionalized membranes which can be used as microsieves, as a component of integrated analytical systems, in food processing, drug discovery and diagnostic applications. This project is based on a combination of three break-through technologies, developed by the applicants in the past, with high impact for nano(bio)technological application: (i) the S-layer technology allowing the construction of nanoporous protein lattices, (ii) the biocatalytic formation of inorganic materials by silicatein, a group of unique enzymes capable to catalyze the formation of porous silica from soluble precursors, and (iii) the sol-gel technique for encapsulation (immobilization) of biomolecules serving as biocatalyst or as a component of sensors. The goal of this project is to design and fabricate - based on molecular biology inspired approaches - nano-porous bio-inorganic membranes with novel functionalities for industrial application. These membranes will be formed by S-layer proteins, which are able to assemble to highly ordered structures of defined pore-size, and recombinant silicateins or silicatein fusion proteins. The hydrated silica glass layer formed by silicatein will be used to encase biocatalysts (enzymes) or antibodies against small molecules as sample prep- or sensor components of integrated systems. The innovative type of the functionalized membranes developed in this project thus exploits two principles: (i) protein self-assembly and - and this has not been done before - (ii) enzymatic (silicatein-mediated) deposition of inorganic material used for reinforcement of the membranes as well as for encasing biomolecules, providing the membranes with new functionalities. The new technique will be exploited by three research-based SMEs and the enduser involved in the project, in microfluidics based sample processing and micro-array development, in industrial nanosieves, as well as in sensors in drinking water systems.

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**NBR: 245122** **ACRONYM: DINAMO** **EC FUND: 2787892**

**DG:** RTD **Call: FP7-KBBE-2009-3** **Thema:** KBBE-2009-3-6-01

**Title:** DEVELOPMENT OF DIAMOND INTRACELLULAR NANOPROBES FOR ONCOGEN TRANSFORMATION DYNAMICS MONITORING IN LIVING CELLS

**Abstract:** Dynamic information about biomolecular processes in living cells is important for fundamental understanding of cellular functions, which is one of the primary targets of molecular cell-biology with important applications to pharmacology. However fur further progress in this field, and this specifically for monitoring genomic processes, there is immense need for developing sensing and detection techniques that can operate with sufficient submicroscopic resolution inside the living cells and bringing real-time information about local biomolecular interactions. The present proposal makes a

further, large step towards integration of forefront nanotechnology, chemistry and molecular biology expertise with a common goal of studying intracellular processes during the evolution steps of several types of frequently occurring cancers. This will create a novel tool studying the molecular processes in cells on nanoscale, which is the objective of this call. The aim of the DINAMO project is to develop the nanodiamond particle (NDP) non-invasive label-free nanotechnology platform for real-time monitoring (1) of living cells modified by oncogenic impact, (2) of the kinetics of gene-assisted processes in the cells. Based on the development work of DINAMO, we propose to apply to apply luminescent and single spin detection techniques for real-time dynamic monitoring of biomolecular processes in cells.

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**NBR: 245162** **ACRONYM: NANOLYSE** **EC FUND: 2945823**

**DG:** RTD **Call: FP7-KBBE-2009-3** **Thema:** KBBE-2009-2-4-01

**Title:** Nanoparticles in Food: Analytical methods for detection and characterisation

**Abstract:** The NanoLyse project will focus on the development of validated methods and reference materials for the analysis of engineered nano-particles (ENP) in food and beverages. The developed methods will cover all relevant classes of ENP with reported or expected food and food contact material applications, i.e. metal, metal oxide/silicate, surface functionalised and organic encapsulate (colloidal/micelle type) ENP. Priority ENPs have been selected out of each class as model particles to demonstrate the applicability of the developed approaches, e.g. nano-silver, nano-silica, an organically surface modified nano-clay and organic nano-encapsulates. Priority will be given to methods which can be implemented in existing food analysis laboratories. A dual approach will be followed. Rapid imaging and screening methods will allow the distinction between samples which contain ENP and those that do not. These methods will be characterised by minimal sample preparation, cost-efficiency, high throughput and will be achieved by the application of automated smart electron microscopy imaging and screening techniques in sensor and immunochemical formats. More sophisticated, hyphenated methods will allow the unambiguous characterisation and quantification of ENP. These will include elaborate sample preparation, separation by flow field fractionation and chromatographic techniques as well as mass spectrometric and electron microscopic characterisation techniques. The developed methods will be validated using the well characterised food matrix reference materials that will be produced within the project. Small-scale interlaboratory method performance studies and the analysis of a few commercially available products claiming or suspect to contain ENP will demonstrate the applicability and soundness of the developed methods.

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**NBR: 245500** **ACRONYM: BACTERIOSAFE** **EC FUND: 3444200**

**DG:** RTD **Call: FP7-NMP-2009-SMALL-3** **Thema:** NMP-2009-1.1-1

**Title:** Active wound dressings based on biological mimicry

**Abstract:** The aim of the Bacteriosafe consortium is to construct, test and develop a unique active wound dressing, which incorporates novel colourimetric sensor and active therapeutic processes for detecting and counteracting pathogenic bacteria in wounds. The inspiration for this project is the natural nano-biological mechanism of bacterial attack on healthy cells. The outer cell walls are ruptured by an array of protein toxins, lipases and other enzymes secreted by these bacteria. We mimic this natural process by using these pathogenic factors to liberate engineered and biologically derived antibiotics/antimicrobials and indicating molecules from highly designed surface immobilized nanocapsules. This will minimize the need for frequent traumatic changes of wound dressing and will provide a simple optical indicator of bacterial infection. In addition to a significant cost reduction, the proposed dressing will minimize the time required for the analysis of bacterial infection. This is particularly critical in burn wounds where delayed detection of bacterial infection can result in patient death. The project will cover both the research into the basic mechanisms of device operation, the development of a prototype device and the process engineering which is necessary to prepare it for large scale industrial production.

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**NBR: 245513** **ACRONYM: NATIOMEM** **EC FUND: 2993230**

**DG:** RTD **Call: FP7-NMP-2009-SMALL-3** **Thema:** NMP-2009-2.6-1

**Title:** Nano-structured TiON Photo-Catalytic Membranes for Water Treatment

**Abstract:** More than 1.2 billion people, mostly in poor regions, suffer from water scarcity, due to a global shortfall of potable water caused by population growth, over-exploitation, and pollution. NATIOMEM proposes to alleviate this by developing novel technology for treating contaminated surface and waste water so that it will be potable. This technology will not require electrical power, chemicals or other logistical support, and hence will be suitable for poor areas lacking infrastructure. The technology uses membranes functionalized with a photocatalytic material, eg. N-doped TiO2 (TiON). Raw water will be directed through the membrane while it is exposed to solar radiation. The membrane will filter out particles and micro-organisms larger than the its pore size, and TiON photocatalysis will kill micro-organisms, decompose and mineralize organic pollutants, and oxidize dissolved metals, thus providing a one-step treatment against a broad spectrum of contaminants. In the NATIOMEM project, functionalized membranes will be developed with two approaches: (1) coating conventional membranes with TiON nanostructured films, using several candidate deposition methods, and (2) electrospinning TiON fibers, from which membranes will be fabricated. The

functionalized membranes will be characterized for their morphological, physical, mechanical, chemical, and in particular, their photocatalytic properties, and the most effective will be extensively tested to determine their pollution abatement mechanisms and kinetics. A pilot plant incorporating these photocatalytic membranes will be designed, and field tested in the Middle East and in Africa. The results of these tests will be correlated with potential end-user requirements to set the stage for industrial exploitation. Achieving this result will be a breakthrough in water purification and reclamation technology, advancing far beyond the state of the art with a system which is simple, solar enabled, and chemical free.

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**NBR: 245542** **ACRONYM: BIO2MAN4MRI** **EC FUND: 1999872**

**DG:** RTD **Call: FP7-NMP-2009-SMALL-3** **Thema:** NMP-2009-1.1-1

**Title:** Biomimetic and Biomineralized Magnetic Nanoparticles for Magnetic Resonance Imaging

**Abstract:** Nanoscience and nanotechnology are currently revolutionizing sectors such as medicine, information technologies, environmental or materials sciences, and creating new opportunities for our societies. In this context, magnetic nanoparticles (MNP) are key components to the development of novel nano- and biotechnologies. Magnetosomes are unique hybrid magnetic MNP produced by magnetotactic bacteria (MB). They are employed in applications ranging from extraction of DNA to the development of immunoassays and uses in spintronics are envisaged. However, only a very limited amount of MNP (few mg per day) can be formed by MB, and the formation principles remain to be tackled. Biomimetics, i.e. combining biological principles with chemistry, will pave the way to understand biomineralization of tailored MNP and to find out high-value high-yield synthetic routes to solve scientific and technological challenges. Specifically, we aspire at bridging the gap between different fields of science. For the first time, we will blend biological and genetic approaches with chemical and physical knowledge to understand the key parameters controlling the size, shape, composition and assembly of hybrid MNP in vivo and in vitro. We will combine nanoscience and nanotechnology to modify these properties and develop an ensemble of magnetic nanomaterials of higher values. This approach will lead to original contributions of innovative nature based on the combined skills of the partners to manufacture and characterize the biological, chemical, structural and magnetic properties of the MNP. The industrial partner will have key importance in managing and assessing the applicability of the MNP in Magnetic Resonance Imaging (MRI). Finally, our cell biologist partner will test the biocompatibility of the designed systems. In 3 years, we aim at being able to synthesize hybrid MNP with tailored magnetic and size properties by low-cost high-yield synthesis for applications in MRI.

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**NBR: 245565** **ACRONYM: LAMAND** **EC FUND: 3463000**

**DG:** RTD **Call: FP7-NMP-2009-SMALL-3** **Thema:** NMP-2009-1.2-2

**Title:** Large Area Molecularly Assembled Nanopatterns for Devices

**Abstract:** Scaling has driven the microelectronics industry for over 40 years and revolutionised information and communication technologies, health care, education, engineering, etc. Maintaining progress has becomes more challenging and costs of fabrication facilities are rising exponentially. Possible technical/cost solutions centre on development of 'bottom-up' techniques to (nano)pattern (the patterns yield device elements) surfaces rather than 'top-down' photolithographic (PL) methods that are the major cost of manufacturing circuitry (a single PL system is ~€65 million for next generation devices). Self-assembly is one route to nanopatterns but regularity/alignment over large areas is not consistent with circuit manufacture. Recent work on the self-assembly of block-copolymer (BCP) systems suggests that realisation of patterns of small feature size (~10 nm), at high density (i.e. spaced at ~10 nm), in precisely defined positions (to an accuracy of < 10 nm) on a large area substrate (12") is possible. This proposal will develop BCP methodology into a set of process techniques for subsequent industrial pre-development. The methodology centres around a combination of bottom-up and top-down techniques to provide the fidelity required to make the methods reproducible and reliable. This proposal would have significant value:- - Enable continued development of devices towards their ultimate performance. - Allow development of advanced circuitry at lower costs. - Prevent monopolisation of the semiconductor industry by 1 or 2 companies that can afford capital costs by opening the market to new competition. - Afford the EU with opportunities to develop profitable companies in materials, process equipment and emerging device technologies. Without a suitable EU-level engagement in this area, competition in the US and Asia will gain a significant technological lead that will minimise the EU's potential to deliver new and advanced nano-electronic devices.

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**NBR: 245572** **ACRONYM: 3MICRON** **EC FUND: 5999412**

**DG:** RTD **Call: FP7-NMP-2009-LARGE-3** **Thema:** NMP-2009-4.0-3

**Title:** Three modality contrast imaging using multi-functionalized microballoons

**Abstract:** In vivo multimodality imaging is a fast growing field in medical research and, although the achievements at clinical level of this diagnostic method are recent, it is already one of the most promising approaches in the diagnosis of diseases in many research addressed medical centres. At present in this area, the USA plays the protagonist role as a result of the amount of resources engaged in the arena in the last decade. Both

government and private companies agree, when considering the potential of this approach, that it is one of the foremost medical advancements as it will lead to early diagnosis of diseases with high impact on the societies of western countries. Multimodality imaging is currently viewed as a simple and powerful integration of two or more imaging methods (e.g. PET-CT). 3MICRON is an ambitious project which gathers some of the most advanced European medical and technical institutions together to address the design of new strategies in diagnostics, and to push the potential of medical imaging beyond the state-of-the-art. The multimodality approaches are supported by a class of next-generation micro/nanodevices called microballoons. These subsystems are able to implement the function of an ultrasound contrast agent with other imaging methods (SPECT, MRI). In the future, they may act as a minimally invasive drug delivery method and hyperthermia device. In 3MICRON, this multi-functional device will be tested in vitro and in vivo in order to assess bioclearance and cytoxicity effects toward high impact diseases, e.g. cardiovascular and inflammation pathologies. Finally, selected types of microballoons will undergo pre-clinical screening for a consolidated assessment of the "bench-to-bed" pathway for these new microdevices.

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**NBR: 245574** **ACRONYM: TALENTS** **EC FUND: 273534**

**DG:** REA **Call: FP7-PEOPLE-COFUND-2008** **Thema:** FP7-PEOPLE-COFUND-2008

**Title:** Talents for an International House

**Abstract:** "Talents for an International House" (TALENTS) has been designed for contributing to the overall objectives of the Specific Programme People and, in particular, of COFUND: in fact the creation of favourable conditions for the international mobility of highly skilled human resources, as well as for the inter-sectoral mobility represent its main factors. TALENTS is a Fellowships Programme developed by AREA, with the endorsement of the Regional Authority of Friuli Venezia Giulia, aimed at ensuring brain circulation and at combating fragmentation throughout Europe. The Programme involves a wide range of public and private scientific institutions operating in many different sectors (Chemistry, Material technologies, Nanotechnologies, Mechanical sciences, Genetic engineering, Biotechnologies and Diagnostic, Physics, Ecology and Environment, Oceanography, Marine biology, Information Technology and Multimedia). This scientific regional System is actually known throughout the world and constitutes a model in which university research, centres of excellence and technology transfer operators cooperate at a local, national and international level to produce, transfer and manage knowledge. The Programme includes both incoming mobility type and outgoing mobility one: the incoming fellows will work freely in the regional research institutions of their choice, even moving among the different institutions available, while the outgoing fellows will develop additional and complementary skills in a high level institution abroad, both in Europe and in a Third country. These fellows will be provided with suitable salaries and the most favourable working and living conditions. The Programme

will guarantee freedom in choosing both the fellowship research topic and the hosting institution. Furthermore the trans-national and inter-sectoral characters of TALENTS offer the opportunity to enhance the researchers capabilities and to widen their future employability.

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**NBR: 245843** **ACRONYM: SOWAEUMED** **EC FUND: 881856**

**DG:** RTD **Call: FP7-REGPOT-2009-2** **Thema:** REGPOT-2009-2

**Title:** NETWORK IN SOLID WASTE AND WATER TREATMENT BETWEEN EUROPE AND MEDITERRANEAN COUNTRIES

**Abstract:** The project foresees the synergic work of participants of various scientific profiles by improvement of scientific relationships, exchange of know-how and experience between the participating centres, including training in MS of Ph.D. students and/or post-doctoral researchers, to upgrade S&T research capacities of centres in MED countries dealing with waste treatment technologies both conventional, advanced and nanoscience based. The proposal includes one SME (Environmental Engineering) in order to give to the project a complementary and applied - business dimension. To be able to participate in the project on an equal-footing basis, the different technological developments of the groups should be balanced by reinforcement of MED countries research infrastructure and improvement of their human potential. This will be achieved by upgrading research equipment in the laboratories of less developed countries and by hiring new senior researchers in these groups. Thus, the transfer and exchange of know-how will be accelerated and the potential of the groups can be better exploited. This approach will prepare laboratories from MED countries to participate more efficiently in European projects. Moreover, it will enable MED countries to increase their contribution in the ERA, making them interesting partners to scientists from MS.

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**NBR: 245916** **ACRONYM: NANOTECH FTM** **EC FUND: 1298774**

**DG:** RTD **Call: FP7-REGPOT-2009-1** **Thema:** REGPOT-2009-1

**Title:** Reinforcing of Nanotechnology and Functional Materials Centre

**Abstract:** In recent years, the advance of contemporary technologies became more closely related to the development of new materials. Exploiting the possibility of designing new materials on micro and nano level as well as composite materials enables their use in various fields such as biomedicine, catalysis, civil engineering, aerospace and process industry. The aim of this project is to contribute to the advance in proposed fields by networking and reinforcing research centers in Serbia as an EU's Convergence

Region, by organizing personnel exchange, performing joint experiments, teaching and training activities with EU networking research and industrial partners. In that way, the research project team will get strong expertise in the synthesis, processing, characterization and testing of nanostructured materials, establishing new advanced processing and characterization methods, also. Special care will be taken towards hiring of experienced and new young researchers in order to reinforce the human potential. This project will also result in upgrading and acquired of the S&T equipment of the centre in order to reinforce internal S&T capacities. This kind of collaboration will result in preparing further cooperative activities and preparation of new joint RTD proposals and reinforcing integration to European Research Area.

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**NBR: 245940** **ACRONYM: MINASYS-COE** **EC FUND: 2003085**

**DG:** RTD **Call: FP7-REGPOT-2009-1** **Thema:** REGPOT-2009-1

**Title:** Micro and Nano Systems Center of Excellence - IMEL/NCSR DEMOKRITOS

**Abstract:** The purpose of the present proposal is to extend and improve the existing facilities and know-how at the Institute of Microelectronics (IMEL) of the National Center for Scientific Research (NCSR) “Demokritos”, recognized as Center of Excellence in Nanoelectronics and MEMS in Greece, and organize and coordinate the access to the infrastructure at regional, national and EU levels. Dissemination and networking activities will be also organized, targeting mainly, but not exclusively, collaborations with the countries in Southeastern Europe in the field of nanofabrication, nanodevices and sensors/MEMS/NEMS. With the existing expertise, know-how and state-of-the-art infrastructure and facilities, complemented by important new equipment that will be purchased within the present proposal, MiNaSys Center of Excellence (MiNaSys-CoE) aims at becoming unique in the Southeastern Europe region. The instruments for the implementation of MiNaSys-CoE will be the following: • Extending and upgrading the existing infrastructure • Recruitment of experienced scientists and engineers • Development of the access to the existing facilities and know-how • Development of networking activities and strategic partnership with other leading research groups in Europe. • Organization of scientific events, thematic sessions and seminars supporting knowledge transfer and research policy development. • Dissemination of results and activities

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**NBR: 245977** **ACRONYM: NASCENT** **EC FUND: 2982855**

**DG:** RTD **Call: FP7-NMP-2009-SMALL-3** **Thema:** NMP-2009-1.2-1

**Title:** SILICON NANODOTS FOR SOLAR CELL TANDEM

**Abstract:** The overall objective of the project is to develop new Nanomaterials with New Production Technologies and to fabricate silicon quantum dot tandem solar cells to achieve increased efficiencies. The understanding of electrical transport and recombination mechanisms in these newly developed nanomaterials will enable us to design new tandem solar cell structures - based on Si thin-film or wafer solar cells - that help to overcome the efficiency limits of these conventional concepts. In order to reach our goals, considerable R+D work has to be performed on semiconductor bulk materials, thin layers and hetero-structures for such solar cells. These topics have not yet or only in parts been investigated and are also of high scientific interest for novel photonic and charge storage devices incorporating Si nanocrystals embedded in Si alloys. The consortium of this project, also including two companies, merges the scientific and technological competences that are necessary to find answers to these questions. Another objective is the compatibility of the newly developed technologies with high-throughput processing to ensure further cost-reduction. The expected significant jump in the solar cell and processing evolution will lead to higher efficiencies for solar cells and to ongoing cost-reduction also with a long-term perspective and will help to strengthening the European leadership in PV technologies. Thus it will also have a positive impact on the acceptance of photovoltaics by the public and by politics. Moreover, since “energy efficiency” is a big subject in the public discussion, photovoltaics will be an example of one of the highest electricity production efficiencies that have been achieved of all power generators. To sum up, we believe that this project will have a direct and positive impact on the European PV industry and its status in material science and it will contribute to the very ambitious goals of the EU commission in CO2 reduction in general.

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**NBR: 245988** **ACRONYM: INCAS** **EC FUND: 5670094**

**DG:** RTD **Call: FP7-NMP-2009-LARGE-3** **Thema:** NMP-2009-3.2-1

**Title:** Integration of Nanoreactor and multisite CAtalysis for a Sustainable chemical production

**Abstract:** The project concept is to combine nanoreactor technology with multisite solid catalyst design to achieve a safer, cleaner and intensified chemical production. The project ideas are the following: (i) From micro- to nano-reactors. Actual microreactor have channels of micrometric size. We will develop a new concept based on the use of nanometric size channels. (ii) Vectorial pathway for multisite catalytic reactions. A limit in cascade (or domino) reactions is that there is no possibility to control the sequence of reactions of transformation of a reactant in a multisite catalyst. The concept of vectorial pathway for multisite catalytic reactions is based on the idea of an ordered sequence of catalytic sites along the axial direction of the channels of a membrane, in order to control the sequence of transformation. (iii) Dynamic nanoreactor. The concept of dynamic

nanoreactor is based on the transient generation of toxic reactants inside the nanoreactor and the immediate conversion, in order to eliminate the storage of these reactants (which is minimized, but not eliminated in on-site or on-demand approaches). The project concept is that the implementation of innovative and safer pathways for sustainable chemical production requires making a step forward in the development of catalyst-reactor design along the lines indicated above. The project applies above ideas to three reactions of synthesis of large-volume chemicals which are relevant example of innovative pathways for sustainable chemical production: (1) direct synthesis of H2O2, (2) PO synthesis with in-situ generated H2O2 and (3) solvent-free synthesis of DPC with in-situ transient generation of phosgene. The consortium has a clear industrial leadership, with sixth major companies and two SMEs, and four academic partners, plus the participation of the durable institution of the NoE IDECAT.

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**NBR: 245993** **ACRONYM: GAMBA** **EC FUND: 3198849**

**DG:** RTD **Call: FP7-NMP-2009-SMALL-3** **Thema:** NMP-2009-2.3-1

**Title:** Gene Activated Matrices for Bone and Cartilage Regeneration in Arthritis

**Abstract:** This consortium develops a novel gene-activated matrix platform for bone and cartilage repair with a focus on osteoarthritis-related tissue damage. The S&T objectives of this project are complemented with an innovative program of public outreach, actively linking patients and society to the evolvement of this project. The GAMBA platform is going to implement a concept of spatiotemporal control of regenerative bioactivity on command and demand. A gene-activated matrix is a biomaterial with embedded gene vectors that will genetically modify cells embedded in the matrix. The platform comprises modules that self-adapt to the biological environment and that can be independently addressed with endogenous biological and exogenous physical or pharmacological stimuli, resulting in a temporally and spatially coordinated growth factor gene expression pattern. This reproduces, within the matrix, key elements of natural tissue formation. The modules are a biomimetic hyaluronan gel, a ceramic matrix, growth factor-encoding gene vector nanoparticles, magnetic nanoparticles and mesenchymal stem cells. Anatomical adaptivity is achieved with engineered thermal properties of the polymer matrix, which embeds other modules, selected according to functional requirements. Mechanical support is provided by Micro Macroporous Biphasic Calcium Phosphate (MBCP™), a resorbable material approved for clinical use. Spatiotemporal control of bioactivity and responsiveness to physiological conditions is represented, firstly, in the spatial distribution and release profiles of gene vectors within the composite matrix and, secondly, by letting local and external biological or physical stimuli activate the promoters driving the expression of vector-encoded transgenes. This innovative concept is implemented by a multidisciplinary team from leading European institutions combining scientific excellence with a focused plan of dissemination, public participation, gender equality and transition to market.

**NBR: 246026** **ACRONYM: RODIN** **EC FUND: 2894280**

**DG:** RTD **Call: FP7-NMP-2009-SMALL-3** **Thema:** NMP-2009-2.1-1

**Title:** Suspended Graphene Nanostructures

**Abstract:** The RODIN-project, which seamlessly integrates experimental, industrial and theoretical work, is organized around the concept of suspended single-and few-layer graphene nanostructures and annealed diamond-like carbon films. These structures are ideal for accessing and engineering the intrinsic material properties of graphene. In particular we will focus on engineering and measuring the mechanical and electromechanical properties. This will be done through sculpting of the suspended structures to desired shapes as well as using thermal post-processing methods. Initially, the graphene will be obtained using standard prototype techniques such as exfoliation and plasma assisted chemical vapor deposition. The main goal of the project, one that requires going beyond the current state of the art in multiple areas and has rapid and substantial industrial impact, is the fabrication and demonstration of a tunable graphene resonator with electronic readout. The performance of a mechanical resonator depends sensitively on materials quality, which makes it an ideal test application for a materials-oriented project.

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**NBR: 246067** **ACRONYM: M-RECT** **EC FUND: 4734829**

**DG:** RTD **Call: FP7-NMP-2009-LARGE-3** **Thema:** NMP-2009-2.5-1

**Title:** Multiscale reinforcement of semi-crystalline thermoplastic sheets and honeycombs

**Abstract:** The M-RECT project aims to create multiscale-reinforced semi-crystalline thermoplastics (PEEK and PPS), which will outperform all reinforced polymers in terms of strength, stiffness, creep and mainly damping by upscaling and further developing state of the art production methods, within cost-efficient manufacturing routes. The envisaged multiscale reinforcement will comprise of dispersed straightened and aligned to polymer molecules multi-walled carbon nanotubes (CNTs) and also fully impregnated, long carbon fibres (CF). In order to achieve this objective a number of novel technological achievements including CNT functionalization techniques, fluid-assisted CNT alignment, microwave and induction heating of composites, out of autoclave manufacturing including bagging techniques, DIRIS sandwich panel production, fluoropolymer radiation-absorbing coatings and polymer optical fibre technology will be further developed and used. The CNT or multi-scale reinforced PEEK or PPS sheets and the resulting sandwich panels will be used as raw material for manufacturing laminated

complex prototypes covering a wide range of industrial applications such as automotive, railroad, aeronautical, space, civil engineering and biomedical. Optimized design of these structures will be based on suitably developed numerical modelling and optimization tools within the proposed project and which will be validated through extensive testing at nano, meso and macro-scale. The anticipated impacts of the development of the envisaged top-performance lightweight thermoplastic composites and their manufacturing routes will extend to an international level by decreasing energy and fuel consumption, decreasing waste production and improving recyclability, creating profitable spin-off activities, promoting safety and improving the urban environment.

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**NBR: 246073** **ACRONYM: GRENADA** **EC FUND: 3445370**

**DG:** RTD **Call: FP7-NMP-2009-SMALL-3** **Thema:** NMP-2009-2.1-1

**Title:** GRaphenE for NAnoscaleD Applications

**Abstract:** The semiconductor industry has been able to improve the performance of electronic system by making ever-smaller devices. However, this approach will soon encounter both scientific and technical limits, which is why the industry is exploring alternative device technologies. Carbon-based nano-electronic is currently investigated. Discovered recently, the graphene is rapidly raising star on the horizon of materials science and condensed-matter physics. Its exceptional properties make it a promising material for applications in future nanoelectronic circuits and a number of graphene based devices have been proposed theoretically or already tested. However, the current performances are still below that what expected from this magic layer. Indeed, the alternative graphene synthesis, its manipulation and its interaction with neighboring environment impact drastically its structural properties considering intrinsic or generated defects. In this context, the key objective of GRENADA proposal is to tailor the graphene's properties and morphologies to provide high quality layers through different scalable deposition technologies. GRENADA consortium will work on graphene material development and properties investigation that be used as a final point in proof concept by operating basic systems to measure the graphene performances. Prior to that, a strong focus will be made on defects that are crucial regarding graphene properties and they will be, then, considered through their formation, evolution and their specific impact on integrated graphene properties. The consortium includes internationally renowned experimental and theoretical groups from academic and industry in advanced elaboration, modelling, characterization and industrialization methods that have a significant potential for graphene nanomaterials. That will ensure a tight focus on the exploitation of the project results for European industry.

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**NBR: 246095** **ACRONYM: POLYCAT** **EC FUND: 6998220**

**DG:** RTD **Call: FP7-NMP-2009-LARGE-3** **Thema:** NMP-2009-3.2-1

**Title:** Modern polymer-based catalysts and microflow conditions as key elements of innovations in fine chemical syntheses

**Abstract:** POLYCAT provides an integrated, coherent and holistic approach utilizing novel polymer based nanoparticulate catalysts in pharmaceutical, crop protection and vitamin syntheses in conjunction with the enabling functions of micro process technology and "green" solvents such as water or ethyl lactate. This provides a discipline bridging approach between fine chemistry, catalysis and engineering. This will lead to the replacement of a number of chemical or microbiological reaction steps in fine chemical syntheses by catalytic ones using more active, selective and stable nanoparticulate catalysts. In addition, POLYCAT will lead to the development of novel chiral modifiers immobilized on the polymeric supports. Micro process technology provides testing under almost ideal processing conditions, with much improved heat management, with improved costing, at high data validity, at high process confidence, and with high certainty for scale-out. The industrial applicability is demonstrated by three selected examples by scale-out to the pilot scale. A multi-purpose, container-type plant infrastructure will integrate individual reaction and separation modules in block format, standardised basic logistics, process control, safety installations, and on-line analytics. As guidance during the whole development, holistic life cycle (LCA) and cost analyses will pave directions towards competitiveness and sustainability. The POLYCAT technologies have potential to reduce the environmental impact by 20% up to orders of magnitude: e.g. reduction of 40 Mt of green house gas emissions, 160 t acids (SO2-Eq.), 200 t nutrients (NOx-Eq.), 12 Mt toxic substances (1,4-DCB Eq.) and 350 t finite abiotic resources (antimony eq.). With (enantio)selectivity increases up to 25%, solvent reductions of 30-100%, and products cost decreases of about 10%, a midterm impact of 30-110 Mio Euro and longterm impact of 100-560 Mio Euro result.

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**NBR: 246102** **ACRONYM: IFOX** **EC FUND: 11302718**

**DG:** RTD **Call: FP7-NMP-2009-LARGE-3** **Thema:** NMP-2009-2.2-1

**Title:** Interfacing Oxides

**Abstract:** The goal of IFOX is to explore, create and control novel electronic and magnetic functionalities, with focus on interfaces, in complex transition metal oxide heterostructures to develop the material platform for novel 'More than Moore' (MtM) and 'beyond CMOS' electronics, VLSI integratable with performance and functionality far beyond the state-of-the-art. To this end it will: -Establish a theoretical basis to identify

the most promising materials/heterostructures and to understand the new functionalities relevant for electronic applications -Grow oxide films on commercial substrates with a quality comparable to state-of-the-art semiconductor growth - Establish their patterning and processing conditions within the boundary conditions of current fabrication technologies -Characterize their structural, electronic and magnetic properties to deliver concepts for novel charge and/or spin based devices in the areas of memories, logic and sensor applications. Investigations include ferroelectric and ferromagnetic oxides as well as artificial multiferroic heterostructures (deposited on large area silicon substrates) with as final deliverable concepts for multifunctional magneto-electronics devices controlled by electric and magnetic fields and ultimately by ultra short light pulses. The consortium of world leaders in the areas of theory, oxide deposition, lithography, device fabrication, and various characterization techniques will allow full control of all interface properties dominating the physical behaviour of oxide nano- and heterostructures. The goals of IFOX are driven by the needs of a large automotive company (FIAT) seeking to use oxides in electronic sensors for MtM and automotive applications. It is further supported by two SMEs with expertise and infrastructure for epitaxial oxide growth on Si with the goal to transfer academic knowledge to industry.

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**NBR: 246176** **ACRONYM: ECOPLAST** **EC FUND: 2820000**

**DG:** RTD **Call: FP7-NMP-2009-SME-3** **Thema:** NMP-2009-2.4-1

**Title:** Research in new biomass-based composites from renewable resources with improved properties for vehicle parts moulding

**Abstract:** The main objective of the project is the development of new biomass-based composites validated for the automotive industry by means of the adaptation of base biopolymers and the generation of new ones, using innovative treatments for fibre reinforcements and the additivation of the base polymer with novel fillers and nanofillers. The principal research line will be focused on the adaptation of available biopolymers (PLA, PHB) and the creation of a new protein-based biopolymer (SELP) for its use as the base matrix to be able to meet automotive standard requirements. To achieve that advance, it is indispensable to improve the thermal characteristics of these polymers, the hydrolysis resistance, the dimensional stability and the volatile emission. Therefore, this project will develop several new reinforcements and novel additives like nanofillers, mineral fillers and treated natural fibres (nanocellulose) to be compounded with these base polymers in order to create new biocomposites. Accordingly, it will be used: a. Nanofillers to increase the thermal resistance. b. Natural fibres and nanocellulose to enhance the dimensional stability and the mechanical resistance. c. Mineral fillers to reduce the moisture absorbency. Another important goal in this project is the adaptation of conventional processing techniques (polymers compounding, injection moulding and thermoforming), widely used in the automotive industry, and the design

of new ones tailored to these biocomposites. The challenge here will be to overcome the problem of degradation because of the extreme thermal conditions and the moisture absorbency.

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**NBR: 246180** **ACRONYM: PANOPTES** **EC FUND: 3900000**

**DG:** RTD **Call: FP7-NMP-2009-SMALL-3** **Thema:** NMP-2009-1.1-1

**Title:** Peptide-based Nanoparticles as Ocular Drug Delivery Vehicles

**Abstract:** This project will develop methodology for the manufacture of novel peptide-based nanoparticles and nanocapsules to satisfy an unmet clinical need: sustained drug delivery to the posterior segment of the eye. The proposed consortium brings together internationally leading groups in self-assembling polypeptide nanoparticle and nanocapsule preparation by chemical (Durham) and genetic (Nijmegen) approaches, drug loading and in vitro release studies (Helsinki & Madrid), in vitro and in vivo assessment of nanoparticle biocompatibility and functionality (Helsinki, Madrid & Tübingen) and polymer synthesis, processing and industrial validation of manufacturing processes (DSM). Polyester micro- and nanoparticles that have been proposed for ocular drug delivery have several major drawbacks: acidic degradation products cause inflammation; drug release is difficult to control; and peptides and proteins are difficult to encapsulate. A platform of novel, peptide-based nanomaterials, formed through bio-inspired self-assembly processes, will be developed to overcome these problems. Peptide-based materials have a number of attractive features: biodegradation gives non-inflammatory products; self-assembly occurs under mild conditions; they possess a rich chemical diversity; they are defined at the sequence level. Polypeptides and peptide hybrid materials will be processed into nanoparticles, polymeric vesicles (polymersomes) and nanocapsules. These biodegradable and biocompatible materials will be used as containers for the loading, controlled release and cellular delivery of therapeutic molecules. The consortium therefore will enable the industrial manufacture of as-yet unobtainable, high value nanotechnology-based products utilising intrinisically low-energy demand nanobiotechnological phenomena. These will produce a step change improvement in the quality of products for sustained drug delivery to the posterior segment of the eye, enhancing the competitiveness of European industry.

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**NBR: 246200** **ACRONYM: NANOSPEC** **EC FUND: 3033843**

**DG:** RTD **Call: FP7-NMP-2009-SMALL-3** **Thema:** NMP-2009-1.2-1

**Title:** Nanomaterials for harvesting sub-band-gap photons via upconversion to increase solar cell efficiencies

**Abstract:** To continue the path of cost reduction in photovoltaics the efficiency of silicon solar cells must be increased. With higher efficiencies more kWh can be produced from the same amount of silicon, which is the dominating cost factor at present. Fundamental loss mechanisms limit the maximum achievable efficiency: around 20% of the incident power is lost, because photons with energies below the band-gap are transmitted. Upconversion of two low energy photons into one usable photon reduces these losses. In this project we will realize upconversion with the help of nanostructures and nanotechnoloy-based materials and show a significant improvement in solar cell efficiency. The combination of upconverting Er-based phosphors with PbSe/PbS core shell quantum dots increases the spectral range of light that is upconverted. The quantum dots will be incorporated into a fluorescent concentrator to achieve concentration within the upconverting device. Both the increased photon flux due to a wider spectral collection and the additional geometric concentration will increase upconversion efficiency because of its nonlinear characteristic. Optical nanostructures shall serve as selectively reflective structures that avoid unwanted parasitic absorption. The development of very efficient quantum dots and suitable host materials, the optimization of the upconverter and the fabrication of photonic structures are main objectives. Additionally, solar cells and system designs will be optimized, to make the best use of upconverted photons. A thorough understanding of the underlying principles is critical for the success, so gaining knowledge about nanostructures and materials is a major goal. The big advantage of this concept is that the solar cells remain fairly unchanged. The proposed concept opens a technology path for an evolutionary development of silicon solar cell technology to efficiencies towards 30%, starting from the solid base of today's established silicon technology.

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**NBR: 246274** **ACRONYM: MAO-ROBOTS** **EC FUND: 3067975**

**DG:** RTD **Call: FP7-NMP-2009-SMALL-3** **Thema:** NMP-2009-1.2-2

**Title:** Methylaluminoxane (MAO) activators in the molecular polyolefin factory

**Abstract:** MAO-ROBOTS address the aspects of call NMP2009-1.2-2 molecular factory. We aim to perform basic research on nano-to-micro-sized systems used for industrial polyolefin (PO) production in order to "develop sustainable processes for nano-structuring for specific applications which should present high potential industrial and/or market relevance." Molecular PO factories consist of methylaluminoxane based structures and a transition metal complex often but not always anchored on a heterogeneous, nano-structured silica support. On the basis of an in-depth understanding of the molecular and supra-molecular assembly and construction principles of MAO we aim to: Create MAO building blocks with a narrow molecular weight distribution and optimum

nanostructure in terms of their activation efficiency, probably in the range of molecular weights ≈1000g/mol, "to achieve components and/or systems with predictable and controllable properties such as the composition and physico-chemical structure." Identify the most productive nano-to-micro structural arrangement (molecular factory layout) of the components MAO, transition metal complex and silica support in order to create "structures with controlled properties over multiple scales, multi-component structures" Establish the basis for reproducible production of the above-identified and newly designed molecular PO factories. Develop methods for quality control of the polyolefin production process in the molecular PO factories on a laboratory scale. Validate the results for the newly developed molecular factories from the laboratory scale by a series of test runs in industrial polyolefin production facilities Stimulate the broader application of nano-structured MAO for an increased spectrum of molecular factories, thereby accessing a broader application range directed towards different specialty polyolefin-based products.

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**NBR: 246310** **ACRONYM: SNAPSUN** **EC FUND: 2294535**

**DG:** RTD **Call: FP7-NMP-2009-SMALL-3** **Thema:** NMP-2009-1.2-1

**Title:** Semiconductor Nanomaterial for Advanced Photovoltaic Solar cells Using New concept of nanocrystal and conductive host

**Abstract:** Renewable energy production is a key driver for innovation in the material domain. Researchers and industries look to reduce the energy cost and to increase the efficiency of PV solar cells. Nanotechnologies and nanomaterials show broad opportunities. Indeed, at the nanoscale level, energy band gaps depend on nanomaterial architectures (nanoparticles size, bulk dispersion, interfaces with embedding matrix). Silicon nanocrystals allow the design of highly efficiency architectures, like multijunction solar cells or low-cost, optimised, thin film solar cells. The usual elaboration technique is based on the deposition of either multilayer or nanocomposite material in which excess silicon is aggregated into nanoparticles through high temperature annealing. No control of nanoparticle size and bulk dispersion is possible. Moreover, only limited surrounding materials could be considered (silicon containing). This prevents any knowledge-based tuning of the material properties. The main objective of SNAPSUN project is to develop a nanomaterial with reliable and tailored characteristics. To overcome limitations described above, fully tailored silicon nanoparticles will be optimised, in terms of size (3nm) and size dispersion (>10%;0.3nm). The SNAPSUN innovation is the incorporation of these silicon nanoparticles in a wide band gap material, such as silicon carbide or Transparent Conductive Oxides (TCO). This architecture will allow band gap engineering through accurate structure control, together with exceptional electrical characteristics (resistivity, carrier lifetime, etc.) in order to produce high conversion efficiencies above 25 %. Control of material structure will arise from the development of very promising processes allowing the separation of nanoparticle generation and embedding matrix

codeposition. Vacuum and wet technologies will be used to target low-cost solar cells with a target production cost below 0.5 €/Wpeak.

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**NBR: 246331** **ACRONYM: NANOPV** **EC FUND: 3970658**

**DG:** RTD **Call: FP7-NMP-2009-SMALL-3** **Thema:** NMP-2009-1.2-1

**Title:** Nanomaterials and nanotechnology for advanced photovoltaics

**Abstract:** The NanoPV project aims at making a breakthrough step-change in photovoltaics by the removal of a set of bottlenecks which have been identified to block the application of nanostructures for high-efficiency, low-cost solar cells. The bottlenecks arise from the present lack of up-scalable processes that can meet the needs for nanomaterials in PV applications, and the lack of relevant equipment and industrial lines. In order to remove these bottlenecks, the main objectives of NanoPV are: 1) To develop technologies that can increase the efficiency and reduce the processing cost of existing silicon solar cell technologies using nano-scale effects provided by nanomaterials to above 20% for wafer based and above 15 % for thin film silicon based solar cells at a processing cost for modules well below 1 €/watt. 2) To design and to fabricate low cost solar cells entirely from nanomaterials by using nanostructures. An efficiency of above 10 % at processing costs well below 1 €/watt is targeted with potential of further significant improvements in the future. 3) To develop up-scalable cost effective processes and equipment in order to implement both enhanced standard solar cells and solar cell based on nanomaterials as well as related modules to existing pilot and industrial lines. 4) To create new market opportunities for the industrial partners. Nanotechnology will be applied for both already existing conventional Si solar cells (wafer and thin-film based) and for advanced solar cells entirely based on nanostructures. The main scientific efforts will be on understanding and exploitation of such nanomaterials as i) 0D quantum dots, nanocrystals and nanoparticles, ii) 1D nanowires and nanorods, and iii) 2D nanomaterials such as ultrathin layers. A large number of specialised technologies will be applied in the project. Therefore, in order to ensure successful completion, a comparatively large consortium of 9 complementary research partners and 3 industries has been assembled.

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**NBR: 246351** **ACRONYM: NPMIMETIC** **EC FUND: 3985587**

**DG:** RTD **Call: FP7-NMP-2009-SMALL-3** **Thema:** NMP-2009-2.3-1

**Title:** Biomimetic nano-fiber-based nucleus pulposus regeneration for the treatment of degenerative disc disease

**Abstract:** The intervertebral discs form the elastic part of the spine. It is composed of the annulus fibrosus, a tough outer layer of fibrocartilage, surrounding an elastic gelatinous core, the nucleus pulposus (NP). With age, the water content of the NP decreases, thus, the mechanical loads concentrate on the annulus. This leads to the NP wear, and cracking with a subsequent inflammation reaction and a prolapsed intervertebral disc. The process forms a cycle of accelerated DDD pathology. The "Gold Standard" for treatment is the "spinal fusion", an extensive surgery, which blocks definitively free spine motion. Surgeons seek new technologies to allow motion preservation, with long-term outcomes. Based on electrospinning proprietary technology of partner NIC and a novel chemically modified ECM-based biopolymer, developed by partner ProCore, the NPmimetic consortium will develop biomimetic nano-polymer based gel for minimally invasive treatment for disc regeneration: Electrospinning technology will be exploited to design and develop nano-fiber based, biocompatible, biodegradable, synthetic scaffold that will mimic mechanical properties of native NP for immediate and short term treatment. Anti-inflammatory drugs will be carried by biodegradable nano-fibers to be gradually released in situ thus, healing and preventing inflammation. Furthermore, the synthetic scaffold will be integrated with the bioactive-polymer that is highly potent in supporting NP cells for long-term cure. A multidisciplinary study will answer scientific and engineering questions raised by the NPmimetic approach, e.g. hydrogel swelling characteristics, drug delivery, and NP cells reaction to the biomimetic gel environment. All will be supervised by a strong leader in spine surgery to define inputs and outputs of the research, from a clinical implementation point of view.

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**NBR: 246362** **ACRONYM: PARYLENS** **EC FUND: 3838646**

**DG:** RTD **Call: FP7-NMP-2009-SMALL-3** **Thema:** NMP-2009-1.1-1

**Title:** PARYLENE based artificial smart LENSes fabricated using a novel solid-on-liquid deposition process

**Abstract:** The main goal of the project PARYLENS is to develop the next generation optical devices, based on an innovative and reliable concept inspired by natural optical systems such as the human and the fly eyes. We propose the following devices to the European citizen and industry: 1) tuneable lenses 2) truly accommodative intraocular lenses 3) bistable flexible displays The development of those devices relies on recent advances in nanotechnology combined with the patented SOLID (Solid On Liquid deposition) process, which offers the possibility to grow a stable solid layer directly onto a liquid, such that the solid uniformly replicates and encapsulates the liquid template. When using the polymer Parylene as solid layer, the resulting interface is perfectly smooth and the liquid template remains unaffected, which is ideal for optical applications. Parylene is stable, biocompatible, highly transparent, and can be deposited in a one-step process also on liquids. PARYLENS proposes to develop low cost yet high quality, reliable smart devices. The actuation of the tuneable lenses will rely on Parylene-based electroactive polymers

and liquid crystals. Tuneable lenses are expected to have an impact on the consumer electronics market (mobile phones, cameras, etc) in addition, the development of low actuation voltages tuneable lenses will profit to the biomedical devices market (artificial eyes, endoscopes, etc). The truly accommodative intraocular lenses will closely mimic the structure and shape of the crystalline lens of the human eye. They will also prevent inflammation and infections. The structure of microlens arrays will be used to develop flexible bistable liquid crystals displays. The consortium is well balanced (12 partners from 8 countries) and goes for full complementarity. It comprises 4 SMEs, 3 universities and 4 research centres. Together they will make this ambitious multidisciplinary project a reality.

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**NBR: 246373** **ACRONYM: OPHIS** **EC FUND: 3939708**

**DG:** RTD **Call: FP7-NMP-2009-SMALL-3** **Thema:** NMP-2009-2.3-1

**Title:** COMPOSITE PHENOTYPIC TRIGGERS FOR BONE AND CARTILAGE REPAIR

**Abstract:** Osteoarthritis (OA) and osteoporosis (OP) are disabling, degenerative bone diseases with significant economic and societal impacts. The incidence of these conditions increases with age but in recent years the number of younger patients has increased, due mainly to factors related to modern life-styles. The efficiency of current pharmacologic and implant-based solutions are limited and often poorly tolerated. OPHIS aims to develop new, engineered biomaterials for the regeneration of both the osteo-chondral region and the vertebral body degenerated by OA and OP. These devices will be based on the unique combination of biological triggers in the form of (i) nanostructured biomaterials able to mimic the extracellular matrices of either bone or cartilage (ii) chemical and biochemical cues able to direct, control and preserve the phenotypes of the relevant cells in their respective histological compartments. OPHIS will explore the frontiers of knowledge of the effect of nano-structures on tissue regeneration and lead to the de-novo design of active structures able to trigger this process. User friendly and highly performing tissue substitutes will be developed as both acellular and cellular matrices for the regeneration of specific anatomical regions compromised by OA and OP. Focus will also be given to the study of the interactions occurring at nano-scale level between the implanted materials and the natural tissues. This information will complement the body of data obtained through clinically reflective in vitro and in vivo models. Dissemination will be integrated step-wise with the strategy for intellectual property protection and exploitation.

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**NBR: 246434** **ACRONYM: WOODLIFE** **EC FUND: 2381399**

**DG:** RTD **Call: FP7-NMP-2009-SMALL-3** **Thema:** NMP-2009-1.2-2

**Title:** Extended service-life and improved properties of wood products through the use of functional nanoparticles in clear coating and adhesive systems

**Abstract:** The long term objective of the WOODLIFE project is to provide coated and glued wood products with substantially improved durability for a more sustainable society. The project aims to develop new water-based clear coating systems for wood with improved UV-absorbing properties, and to develop new water-based thermoplastic wood adhesives with improved mechanical properties. The new coating and adhesive systems will be designed through molecular manufacturing of inorganic nanoparticles, nanoclays and composite organic-inorganic binders with predictable and controllable properties. Wood is an excellent building material with a high strength/density ratio and it is a renewable resource. For outdoor use it is, however, necessary to enhance the durability of wood materials due to the high sensitivity for UV degradation. Traditionally, organic UV-absorbers are used in clear coatings for wood, however these substances degrade upon outdoor weathering. New UV-absorbing systems for clear coats will be developed in the project based on nanoparticles of CeO2, ZnO and TiO2. With these new systems the service-life of the coated wood will be extended and the cost for maintenance and wood replacement will be decreased. If the mechanical properties of water-based thermoplastic wood adhesives such as PVAc can be improved it would be possible to use the wood products based on these systems for a longer time, leading to a more sustainable society. It would also be possible to use PVAc adhesives instead of the more expensive MUF/PRF adhesives in some load-bearing applications. Engineered nanoparticles will be developed in the project and will be introduced into wood adhesives in order to improve the properties of wood-adhesive joints. The nanoparticles and nanoclays that will be developed in the project will either be added directly to water-based systems or incorporated in hybrid binders in order to improve the dispersion of the nanoparticles and to improve storage stability.

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**NBR: 246449** **ACRONYM: BUGWORKERS** **EC FUND: 3400430**

**DG:** RTD **Call: FP7-NMP-2009-SME-3** **Thema:** NMP-2009-2.4-1

**Title:** New tailor-made PHB-based nanocomposites for high performance applications produced from environmentally friendly production routes

**Abstract:** The project aims to develop a new cost-competitive and environmentally friendly bionanocomposite material based on the combination of a polyhydroxybutyrate (PHB) matrix with new chemical, structure produced by new fermentation culture technology with two types of nanofibres,cellulose whiskers and lignin-based, in order to have a true alternative to engineering materials in two main sectors: household appliances, computers & telecommunications. To fulfil this global objective, current limitations of

PHB polymers and their composites will be overcome using a synergic combination of different approaches: •A tailor-made PHB biopolymer structure obtained using new fermentation culture conditions, i.e, by synergic combination of different media and precursor feedings (specific sugar blends) obtained from hydrolyzed bio-mass, being able to select a structure to provide a PHB with enhanced functionalities (improved thermal and chemical properties, cellulose compatibility, processing, higher impact,..) in comparison with commercial ones. •To improve the cost competitiveness of PHB biopolymer by optimization of the fermentation process (increasing yield) and the use of lingo-cellulose biomass and other industrial by-products as fermentation feedstock. It will be no competition with food supply. •Development of cellulose whiskers and lignin nanofibres using enzymatic production routes with new functionalities (antimicrobial, flame retardant and self-assembly) from wood waste. •Compounding of new PHB with a synergic combination of both types of nanofibres and long natural fibres, using the planetary multi-screw extruder for improved nanofibres distribution, reducing thermal degradation,improve matrix-nanofibre interphase and introduction of coupling agents by reactive extrusion. •Development of multilayer structures (co-extrusion and co-injection) in order to obtain multifunctional material properties to improve the final performance of plastic parts in select sectors.

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**NBR: 246479** **ACRONYM: NAMDIATREAM** **EC FUND: 11999205**

**DG:** RTD **Call: FP7-NMP-2009-LARGE-3** **Thema:** NMP-2009-4.0-3

**Title:** NANOTECHNOLOGICAL TOOLKITS FOR MULTI-MODAL DISEASE DIAGNOSTICS AND TREATMENT MONITORING

**Abstract:** NAMDIATREAM will develop a cutting edge nanotechnology-based toolkit for multi-modal detection of biomarkers of most common cancer types and cancer metastases, permitting identification of cells indicative of early disease onset in a high-specificity and throughput format in clinical, laboratory and point-of-care devices. The project is built on the innovative concepts of super-sensitive and highly specific “lab-on-a-bead”, “lab-on-a-chip” and “lab-on-a-wire” nano-devices utilizing photoluminescent, plasmonic, magnetic and non-linear optical properties of nanomaterials. This offers groundbreaking advantages over present technologies in terms of stability, sensitivity, time of analysis, probe multiplexing, assay miniaturisation and reproducibility. The ETP in Nanomedicine documents point out that nanotechnology has yet to deliver practical solutions for the patients and clinicians in their struggle against common, socially and economically important diseases such as cancer. Over 3.2M new cases and 1.7M cancer-related deaths are registered in Europe every year, largely because diagnostic methods have an insufficient level of sensitivity, limiting their potential for early disease identification. We will deliver •Photoluminescent nanoparticle-based reagents and diagnostic chips for high throughput early diagnosis of cancer and treatment efficiency assessment •Nanocrystals enabling plasmon-optical and nonlinear optical monitoring of molecular

receptors within body fluids or on the surface of cancer cell •Multi-Parameter screening of cancer biomarkers in diagnostic material implementing segmented magnetic nanowires •Validation of nano-tools for early diagnosis and highly improved specificity in cancer research. •OECD-compliant nanomaterials with improved stability, signal strength and biocompatibility Direct lead users of the results will be the diagnostic and medical imaging device companies involved in the consortium, clinical and academic partners

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**NBR: 246513** **ACRONYM: NADINE** **EC FUND: 9000000**

**DG:** RTD **Call: FP7-NMP-2009-LARGE-3** **Thema:** NMP-2009-4.0-3

**Title:** Nanosystems for the early Diagnosis of Neurodegenerative diseases

**Abstract:** Medical diagnosis is currently undergoing a major revolution due to the fast discovery of molecular biomarkers, and the development of multimodal “metabiomarker” signatures. Progress, however, is hindered by low abundance of many biomarkers of interest in body fluids, in absolute concentration and with regard to other biomolecules. The aim of the present project is to apply these progresses in biotechnology, nanoparticle synthesis, and nano-instrumentation to the development of fully integrated lab-on chip instruments able to perform elaborate multimodal biomarker analysis on a routine basis and at the ultrasensitive level required to allow minimally invasive tests. In particular, we aim at overcoming a major bottleneck on the path to this objective, which was identified in a previous project in the “HEALTH” priority: no satisfactory solution currently exists to bridge the several orders of magnitude between the nanoscale volumes at which ultrasensitive new generation sensors operate, and the often millilitre volumes of samples in which the molecules of interest must be found. For this, we shall combine innovations in pre-concentration, micro and nanofluidics, self-assembly, micro-nanofabrication, and nanodetection. The project will develop a generic, multipurpose, platform of compatible enabling technologies, and integrate them into devices. In order to maximize impact and societal benefit, the project will be validated on an application of major interest for health, namely the early detection of biomarkers for neurodegenerative diseases (including Alzheimer), with special emphasis on subtyping of these diseases for improved treatment strategies. The consortium includes a multidisciplinary group of technology developers, three leading biomedical groups in clinical neuroscience for definition of specifications and end-user pre-clinical validation, and three research-oriented SMEs in biotechnology, nanosensing and microfluidics.

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**NBR: 246622** **ACRONYM: GRAPHENOCHEM** **EC FUND: 1436400**

**DG:** ERCEA **Call: ERC-2009-AdG** **Thema:** ERC-AG-PE5

**Title:** Large Scale Production, Cloning, Chemical Functionalization and Materials Applications of Graphene

**Abstract:** We propose the development of modern wet chemical concepts for the mass production and chemical modification of graphene - a rapidly rising star on the horizon of materials science - opening the door for superior but still elusive applications such as transparent electrodes, field effect transistors, solar cells, gas sensors and polymer enforcement. Owing to its spectacular electronic properties graphene is expected to be the most promising candidate to replace classical Si-technology and no longer requires any further proof of its importance in terms of fundamental physics. However, fully exploiting the proposed applications requires the availability of processable graphene in large quantities, which generally has been considered to be an insurmountable challenge. This is where the GRAPHENOCHEM project sets in. Our laboratory has been pioneering and is at the forefront of carbon allotrope chemistry. After having investigated basic principles for the functionalization of the 0-dimensional fullerenes and the 1-dimensional carbon nanotubes, which lead to synthesis of numerous examples of derivatives with tailor made properties, we recently started successfully with the investigation of wet chemical approaches for the efficient production of graphene sheets using graphite as an inexpensive starting material. The strategy of GRAPHENOCHEM is to combine chemistry, nanotechnology and materials science to establish highly efficient protocols for the mass production of soluble graphene and the subsequent processing to a whole variety of thins films, composites and devices with outstanding properties. To our knowledge we are the first synthetic organic chemists facing this challenge. We propose to go through the following sequential key objectives, namely: Development of efficient protocols for the mass production of soluble single layer graphene, cloning of graphene, chemical functionalization and doping of graphene, and engineering of graphene based materials and devices.

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**NBR: 246633** **ACRONYM: R&D ACCESS** **EC FUND: 1449283**

**DG:** CNECT **Call: FP7-ICT-2009-4** **Thema:** ICT-2009.3.2

**Title:** Access to research results on semiconductor design

**Abstract:** The objective of the R&D ACCESS proposal is to identify R&D results on semiconductor design from FP7 projects and to provide these results to partners from outside the consortia. The R&D results are divided into four categories: 1) Training and Education, 2) Intellectual Properties, 3) Design Tools and 4) Design Methodologies. A dissemination platform will facilitate the access to project results generated in huge numbers of IP, NoE, STREP and CSA projects from the FP7 programme. The ACCESS platform will support the exploitation in as well industry (large enterprises and SMEs) as in academia.

Initially the platform content will be based on the FP7 generated results, however, when the platform is implemented and routines for best practice have been established also relevant project results originating from e.g. FP6, ENIAC, ARTEMIS and national programmes will be invited to join the ACCESS platform. A successful implementation of the initiative will: -Facilitate knowledge dissemination across Europe by means of a European RTD knowledge Infrastructure with initially more than 20.000 items (training courses, IPs, tools and methodologies) -A one-stop shop with single sign-on for the dissemination of professional semiconductor design knowledge -Organize annual workshops on application specific nanoelectronics platforms supporting the design in advanced processes -Provide an initial user community of more than 40.000 European semiconductor designers

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**NBR: 246645** **ACRONYM: ASC3** **EC FUND: 2301600**

**DG:** ERCEA **Call: ERC-2009-AdG** **Thema:** ERC-AG-PE4

**Title:** Asymmetric Cluster Catalysis & Chemistry

**Abstract:** The objective of the present scientific proposal is the implementation of a novel approach in selective and asymmetric heterogeneous catalysis. We aim to exploit the structure and chirality of small, supported metal and bimetal clusters for triggering selective and enantioselective reactions. Our Ansatz is beyond doubt of fundamental nature. Although chemistry and in particular catalysis evolved on a largely empirical basis in the past, we strongly believe the complexity of the challenges at hand to make this a less ideal approach. In consequence, developing selective and asymmetric cluster catalysis will be based on a detailed molecular understanding and will not only require intense methodological developments for the synthesis and characterization of asymmetric catalysts and the detection of chiral and isomeric product molecules but also make use of innovative basic science in the fields of surface chemistry, cluster science, spectroscopy and kinetics. As complex as the involved challenges are, we aim at mastering the following ground-breaking steps: (a) development of cutting-edge spectroscopic methodologies for the isomer and enantiomer sensitive in situ detection of product molecules. (b) preparation and characterization of isomer- and enantioselective heterogeneous catalysts based on chiral metal clusters or molecule-cluster-complexes. (c) investigations of the selectivity and enantioselectivity of cluster based heterogeneous catalysts and formulation of concepts for understanding the observed selective and asymmetric chemistry. Besides the importance of the science carried out within this proposal, the proposed experimental methodology will also open up opportunities in other fields of chemistry like catalysis, analytical chemistry, spectroscopy, surface science, and nanomaterials.

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**NBR: 246688** **ACRONYM: BIONANOTOOLS** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2009-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Protein design to generate bio-functional nanostructures

**Abstract:** The main objective of my research project is to understand how the structure and function of proteins are defined by their sequence and to apply learned rules to design new protein-based nanotools. In particular, I will focus on a type of proteins called tetratricopeptide repeats (TPR). They present a simple modular structure, where a small structural unit is repeated in tandem. Overall TPR domains are a very robust system to study protein structure, folding, and function, and to use them as building blocks for protein engineering to generate new functional nano-molecules. I aim to study natural TPR domains that mediate protein-protein interactions at a molecular level, and extract basic principles that govern these interactions to apply them in the design of TPR units with desired specific activities. I will also perform basic studies on protein stability and folding of designed TPRs to gain a better understanding on how the protein sequence determines thermodynamic stability. These studies will allow us to generate more stable proteins that will be useful in biotechnological applications, such as generation of novel biomaterials. The ability to discriminate between residues that determine the structure and stability, from those responsible of the binding specificity in the protein scaffolds, together with the capacity to generate super-stable scaffolds, opens the door to the generation of protein libraries. In such libraries only the binding sites will be randomized in order to incorporate a wide variety of potential specificities, and will be screened against different targets of interest using high-throughput methods. We will design functional proteins with defined binding-specificities and structural properties. These novel bio-tools will be extremely useful to monitor and investigate biological processes in vivo, as biosensors for diagnosis to detect disease biomarkers, and also as building blocks for applications in biomaterials design.

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**NBR: 246749** **ACRONYM: BIOCARB** **EC FUND: 2182000**

**DG:** ERCEA **Call: ERC-2009-AdG** **Thema:** ERC-AG-ID1

**Title:** Carbonate Biomineralization in the Marine Environment: Paleo-climate proxies and the origin of vital effects

**Abstract:** This interdisciplinary proposal has the objective to greatly enhance our understanding of fundamental biomineralization processes involved in the formation of calcium carbonates by marine organisms, such as corals, foraminifera and bivalves, in order to better understand vital effects. This is essential to the application of these carbonates as proxies for global (paleo-) environmental change. The core of the proposal is an

experimental capability that I have pioneered during 2008: Dynamic stable isotopic labeling during formation of carbonate skeletons, tests, and shells, combined with NanoSIMS imaging. The NanoSIMS ion microprobe is a state-of-the-art analytical technology that allows precise elemental and isotopic imaging with a spatial resolution of ~100 nanometers. NanoSIMS imaging of the isotopic label(s) in the resulting biocarbonates and in associated cell-structures will be used to uncover cellular-level transport processes, timescales of formation of different biocarbonate components, as well as trace-elemental and isotopic fractionations. This will uncover the origin of vital effects. With this proposal, I establish a new scientific frontier and guarantee European leadership. The technical and scientific developments resulting from this work are broadly applicable and will radically change scientific ideas about marine carbonate biomineralization and compositional vital effects.

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**NBR: 246763** **ACRONYM: NANOSONWINGS** **EC FUND: 3495000**

**DG:** ERCEA **Call: ERC-2009-AdG** **Thema:** ERC-AG-ID1

**Title:** A new vision on nanocatalysts

**Abstract:** In recent years it has been recognized that small metal nanoparticles hold the promise that their catalytic properties may be completely different from those of their bulk analogs or their monometallic complexes. Entirely new chemical conversions may be expected because of their shape and thermodynamic properties. So far, this promise has not led to important breakthroughs, as most findings can be categorized, mostly, as typical of homogeneous catalysis, or mimics of heterogeneous catalysts, especially hydrogenation. Nanoparticles need stabilizating reagents; polymers, dendrimers, ionic liquids, detergents, solid surfaces, and small ligands, have been discovered and used by trial and error. In this project we propose the use of concave, large organic molecules that will be developed and used to stabilize small nanoparticles by covering part of the vertices and apices, thereby controlling the size and the shape, leaving edges next to the molecular wings and uncovered surface available for interactions leading to catalysis. The controlling wings contain two or three strongly binding phosphines to prevent dissociation of the controlling agent and to modify, simultaneously the electronic properties of part of the metal atoms. The organic platforms have the advantage that additional groups can be connected to them which can serve as chiral modifiers, as recognition sites for larger molecules, as additional organic catalysts, or as ligands to hold a homogeneous co-catalyst. Three high-risk reactions will be investigated, (enantio)selective hydrogenation of aromatics, conversion of glycerol to high added value products and the selective conversion of syn gas by using devices derived from homogeneous and supramolecular catalysis.

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**NBR: 246775** **ACRONYM: NUMERIWAVES** **EC FUND: 1662999**

**DG:** ERCEA **Call: ERC-2009-AdG** **Thema:** ERC-AG-PE1

**Title:** New analytical and numerical methods in wave propagation

**Abstract:** This project is aimed at performing a systematic analysis, providing a real breakthough, of the combined effect of wave propagation and numerical discretizations, in order to help in the development of efficient numerical methods mimicking the qualitative properties of continuous waves. This is an important issue for its many applications: irrigation channels, flexible multi-structures, aeronautic optimal design, acoustic noise reduction, electromagnetism, water waves, nonlinear optics, nanomechanics, etc. The superposition of the present state of the art in Partial Differential Equations (PDE) and Numerical Analysis is insufficient to understand the spurious high frequency numerical solutions that the interaction of wave propagation and numerical discretizations generates. There are some fundamental questions, as, for instance, dispersive properties, unique continuation, control and inverse problems, which are by now well understood in the context of PDE through the celebrated Strichartz and Carleman inequalities, but which are unsolved and badly understood for numerical approximation schemes. The aim of this project is to systematically address some of these issues, developing new analytical and numerical tools, which require new significant developments, much beyond the frontiers of classical numerical analysis, to incorporate ideas and tools from Microlocal and Harmonic Analysis. The research to be developed in this project will provide new analytical tools and numerical schemes. Simultaneously, it will contribute to significant progress in some applied fields in which the issues under consideration play a key role. In parallel with the analytical and numerical analysis of these problems, a mathematical simulation platform will be set to perform computer simulations and explore and visualize some of the most relevant and complex phenomena.

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**NBR: 246784** **ACRONYM: SPINMET** **EC FUND: 396000**

**DG:** REA **Call: FP7-PEOPLE-2009-IRSES** **Thema:** FP7-PEOPLE-2009-IRSES

**Title:** Spin related phenomena in mesoscopic transport

**Abstract:** The rapid progress of nanotechnology made possible the realization of nano-devices in which the motion of the carriers obeys the laws of quantum mechanics. They offer a unique laboratory for study of fundamental quantum effects, such as entanglement, topological phase and new states of matter arising from many- body correlations. Besides, mesoscopic objects can serve as components of the electronic and optoelectronic devices of new generation. In this perspective the study spin related

phenomena is of particular importance as use of the spin degree of freedom opens a way to practical realization of such nanodevices as single electron memory elements, spin transistors, quantum beam splitters and spin filters. Another important topic in the field of mesoscopic transport is connected with many- body correlations, which manifest itself via variety of intriguing physical phenomena. In many of them spin plays a major role. The analysis of an interplay between spin dynamics and mesoscopic many- body correlations is thus an actual task. In a current Multidisciplinary Marie Curie FP7-PEOPLE-IRSES project SPINMET we plan to analyse many body spin related phenomena in various types of mesoscopic structures focusing on following main topics: i) Spin-interference phenomena in non-single connected mesoscopic objects ii) “0.7 anomaly” and related phenomena in 1D ballistic transport iii) New states of quantum spinor 1D liquids. iv) Spin currents and spin accumulation in real mesoscopic structures. The final objective to understand the mechanisms governing mesoscopic spin dynamics and its interplay with many-body correlations and formulation of practical recommendations for their applications in High-Tech industry: silicon spin transistor without ferromagnetic contacts; resistance standard based on the quantum spin Hall effect etc.

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**NBR: 246791** **ACRONYM: COUNTATOMS** **EC FUND: 2000160**

**DG:** ERCEA **Call: ERC-2009-AdG** **Thema:** ERC-AG-PE5

**Title:** Counting Atoms in nanomaterials

**Abstract:** COUNTING ATOMS IN NANOMATERIALS Advanced electron microscopy for solid state materials has evolved from a qualitative imaging setup to a quantitative scientific technique. This will allow us not only to probe and better understand the fundamental behaviour of (nano) materials at an atomic level but also to guide technology towards new horizons. The installation in 2009 of a new and unique electron microscope with a real space resolution of 50 pm and an energy resolution of 100 meV will make it possible to perform unique experiments. We believe that the position of atoms at an interface or at a surface can be determined with a precision of 1 pm; this precision is essential as input for modelling the materials properties. It will be first applied to explain the fascinating behaviour of multilayer ceramic materials. The new experimental limits will also allow us to literally count the number of atoms within an atomic columns; particularly counting the number of foreign atoms. This will not only require experimental skills, but also theoretical support. A real challenge is probing the magnetic and electronic information of a single atom column. According to theory this would be possible using ultra high resolution. This new probing technique will be of extreme importance for e.g. spintronics. Modern (nano) technology more and more requires information in 3 dimensions (3D), rather than in 2D. This is possible through electron tomography; this technique will be optimised in order to obtain sub nanometer precision. A final challenge is the study of the interface between soft matter (bio- or organic materials) and hard matter. This was hitherto impossible because of the

radiation damage of the electron beam. With the possibility to lower the voltage to 80 kV and possibly 50 kV, maintaining more or less the resolution, we will hopefully be able to probe the active sites for catalysis.

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**NBR: 246810** **ACRONYM: NANOSYS** **EC FUND: 2499594**

**DG:** ERCEA **Call: ERC-2009-AdG** **Thema:** ERC-AG-PE6

**Title:** Nanosystems: Architectures, Design and Applications

**Abstract:** Nanosystems are integrated systems exploiting nanoelectronic devices. In particular, this proposal considers silicon nanowire and carbon nanotube technologies as replacement/enhancement of current silicon technologies. This proposal addresses high-risk, high-reward research, unique in its kind. The broad objective of this proposal is to study system organization, architectures and design tools which, based on a deep understanding and abstraction of the manufacturing technologies, allow us to realize nanosystems that outperform current integrated systems in terms of capabilities and performance. Thus this proposal will address modelling of technological aspects, synthesis and optimization of information processing functions from high-level specifications into the nanofabric, and new design technologies for specific aspects of nanosystems including, but not limited to, sensing and interfacing with the environment. This proposal will address also cross-cutting design goals such as ultra-low power and high-dependability design, with the overall objective of realizing nanosystems that are autonomous (w.r. to energy consumption) and autonomic (i.e., self healing). The scientific novelty of this proposal stems from the use of a nanofabric, where computation, sensing and communication are supported by a homogeneous means as well as from the study of algorithmic tools for mapping high-level functions onto the nanofabric. The intrinsic benefit of this research is to provide a design flow that extends both the technological basis and the capabilities of integrated systems, thus strengthening the industrial European position in a key sector where disruptive innovation is key for survival. The extrinsic benefit of this research is to broaden the use of nanosystems to new domains, including mobile/distributed embedded systems, health/environment management, and other areas that are critical to our lives.

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**NBR: 246812** **ACRONYM: INTERCOM** **EC FUND: 2147726**

**DG:** ERCEA **Call: ERC-2009-AdG** **Thema:** ERC-AG-PE4

**Title:** The Influence of Interfaces, Confinement and Compartmentalization on Chemical Reactions

**Abstract:** Water is essential for life on our planet and is the solvent of choice for Nature to carry out her syntheses. In contrast, our methods of making complex organic molecules have taken us far away from the watery milieu of biosynthesis. Indeed, it is fair to say that most organic reactions commonly used both in academic laboratories and in industry fail in the presence of water or oxygen. At the same time of course, chemical reactors are very different from the cellular environment where Nature s synthesis is carried out. This research proposal aims to incorporate some of the key characteristic of cellular reactors, i.e. confinement, compartmentalization and interfaces, into model droplet-based reactors. The envisioned reactors will comprise of monodisperse aqueous droplets in oil carrier phases with volumes ranging from pL to nL, produced in microfluidics devices or in tubing, in very large numbers. These droplets will have precisely determined interfacial areas, which can be used for the study of so-called on water reactions, a new area of synthetic chemistry rapidly gaining in interest. Furthermore, the interfaces can be functionalized with catalytically active surfactants and by confining the droplets into ever decreasing volumes, the effect of nanoconfinement on enzymatic and other reactions can be studied. Finally, individual droplets provide a completely compartmentalized environment, suitable for the study of single enzymes in a crowded environment, but also for systematic studies into communication between compartmentalized, mutually incompatible, reaction systems. This proposal presents a radically new approach to increasing our understanding of chemical reactions in confined spaces and at interfaces and provides a technological platform for the creation of chemically linked networks with emerging complexity.

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**NBR: 246829** **ACRONYM: SUPOCOSYS** **EC FUND: 1947937**

**DG:** ERCEA **Call: ERC-2009-AdG** **Thema:** ERC-AG-PE5

**Title:** From Supramolecular Polymers to Compartmentalized Systems

**Abstract:** This ERC Grant proposal aims to explore the many challenges offered by non-covalent synthesis of functional supramolecular systems. This proposal will use the many possibilities of supramolecular polymers and how we envisage the construction of supramolecular compartmentalized systems based on specific secondary interactions. By studying the mechanisms of the formation of supramolecular polymers, new entrees are foreseen to limit the degree of supramolecular polymers by anti-cooperative mechanisms and to control both the depolymerization and polymerization aiming at supramolecular polymerization processes out of equilibrium. These insights will be used to design, synthesize and self-assembly materials that dynamically adapt their properties to cells that are brought in contact with these biomaterials. With these materials, parts of a bioartificial kidney will be made. With all the knowledge obtained through the years, we have recently introduced a concept to stepwise create folded macromolecules making use of our well-known supramolecular units. These single chain nanoparticles with internal structure are now proposed to be the starting point for making

compartmentalized three-dimensional systems that possess functionality similar to proteins. Therefore, also novel techniques to synthesize well-defined polymers are introduced.

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**NBR: 246841** **ACRONYM: DCENSY** **EC FUND: 2499000**

**DG:** ERCEA **Call: ERC-2009-AdG** **Thema:** ERC-AG-PE4

**Title:** Doping, Charge Transfer and Energy Flow in Hybrid Nanoparticle Systems

**Abstract:** We target a frontier in nanocrystal science of combining disparate materials into a single hybrid nanosystem. This offers an intriguing route to engineer nanomaterials with multiple functionalities in ways that are not accessible in bulk materials or in molecules. Such control of novel material combinations on a single nanoparticle or in a super-structure of assembled nanoparticles, presents alongside with the synthesis challenges, fundamental questions concerning the physical attributes of nanoscale systems. My goals are to create new highly controlled hybrid nanoparticle systems, focusing on combinations of semiconductors and metals, and to decipher the fundamental principles governing doping in nanoparticles and charge and energy transfer processes among components of the hybrid systems. The research addresses several key challenges: First, in synthesis, combining disparate material components into one hybrid nanoparticle system. Second, in self assembly, organizing a combination of semiconductor (SC) and metal nanoparticle building blocks into hybrid systems with controlled architecture. Third in fundamental physico-chemical questions pertaining to the unique attributes of the hybrid systems, constituting a key component of the research. A first aspect concerns doping of SC nanoparticles with metal atoms. A second aspect concerns light-induced charge transfer between the SC part and metal parts of the hybrid constructs. A third related aspect concerns energy transfer processes between the SC and metal components and the interplay between near-field enhancement and fluorescence quenching effects. Due to the new properties, significant impact on nanocrystal applications in solar energy harvesting, biological tagging, sensing, optics and electropotics is expected.

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**NBR: 246912** **ACRONYM: POLAPHEN** **EC FUND: 370800**

**DG:** REA **Call: FP7-PEOPLE-2009-IRSES** **Thema:** FP7-PEOPLE-2009-IRSES

**Title:** Polarization Phenomena in Quantum Microcavities

**Abstract:** The investigation of light-matter interactions nano- scale objects attracts the growing interest of researchers. This interest is largely motivated by the possibility of reaching

the strong light-matter coupling regime, where the elementary excitations – polaritons – have a hybrid, half-light half-matter nature. The unusual properties of the polaritons make them a unique laboratory for study of fundamental quantum effects such as high temperature Bose Einstein condensation, superfluidity, entanglement etc. The important property of the polaritonic systems is their polarization (spin) properties. The interplay between bosonic stimulated scattering of cavity polaritons and their spin precession under effective magnetic fields of various origin makes polarization dynamics in quantum microcavities extremely rich and interesting from fundamental point of view. Moreover, the possibility to manipulate spin of polaritons opens a way to experimental realization of optoelectronics devices of new generation, i.e. spinoptronic devices. With respect to optics, spin-optronics has the advantage of being able to use well controlled carrier interactions occurring in nanostructures. With respect to 'spintronics', it has the advantage of strongly reducing the dramatic impact of carrier spin relaxation or decoherence, which has severely limited the achievement or the functionality of any working semiconductor-based spintronic devices. Our research will be aimed at theoretical study of the coherent polarization (spin) phenomena in quantum microcavities with embedded quantum wells and dots in order to formulate practical recommendations for design of various spinoptronic devices: all- optical locical gates, optical circuits, polarization filters and sources of entangled photon pairs. In order to achieve this goal we created the distributed consortium (network) of partner institutions, located in EU and associated countries (Iceland, France, UK) and in Eligible Third Countries (Mexic

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**NBR: 246937** **ACRONYM: SIMTECH** **EC FUND: 712800**

**DG:** REA **Call: FP7-PEOPLE-2009-IRSES** **Thema:** FP7-PEOPLE-2009-IRSES

**Title:** New Century of Superconductivity: Ideas, Materials, Technologies

**Abstract:** This project is devoted to the new trends in superconductivity. It contains both experimental and theoretical component. We intend to realize the new superconductive nano-systems with high critical parameters, to study the possibility of superconductivity in the system of relativistic electrons in graphene, pumping effect in Josephson systems, a new mechanism of interaction between electrons of two Fermi seas, mediated by excitations of a Bose-Einstein condensate of exciton-polaritons, to develop a new diagnostic methods based on the fluctuation spectroscopy, to apply them for investigation of the pseudo-gap state properties of HTS. In the present project the experts in superconductivity of the highest international recognition take part side by side with young researchers from five institutions of four countries. The network institutions are located in the EU countries (France, Italy) and in the Eligible Third Countries of the former Soviet Union (Russia, Ukraine). Each of them has its own specialization and is related with others by virtue of already existing traditional collaborative links, partially supported by different national or bilateral programs. In the

course of the project we are going to exploit the existing collaboration links and to create the new ones between partners. The main goal of the project is studying and optimization of the mechanisms of realization of the superconductivity in novel systems and materials. Series of bilateral visits, training workshops and meetings are planned for this purpose.

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**NBR: 246953** **ACRONYM: MALADY** **EC FUND: 1372720**

**DG:** ERCEA **Call: ERC-2009-AdG** **Thema:** ERC-AG-PE1

**Title:** MACROSCOPIC LAWS AND DYNAMICAL SYSTEMS

**Abstract:** Physics provides descriptions of the world at many different scales, yet the relations between such descriptions are poorly understood. In particular, since Boltzmann and Einstein, we interpret the world we see as the product of the microscopic dynamics of a large number of atoms. In spite of this, no satisfactory rigorous derivation of a macroscopic equation (e.g. the heat equation) from such a microscopic physical model exists. This sorry state of affairs is extremely unsatisfactory both from the theoretical point of view and for applications. Indeed, as the technology is entering the mesoscopic scale (nanotechnology), the need for a rigorous understanding of how the phenomenological macroscopic laws emerge and of their limits of validity becomes paramount. We believe that recent advances in the theory of Dynamical Systems and Probability, to which the members of our team have contributed, allow key progresses in the understanding of the above problem. The ultimate goal of this proposal is the derivation of macroscopic evolution laws from a microscopic Hamiltonian evolution. To this end we will consider a series of intermediate models: a) inspired to an anharmonic chain with some noise (of a fixed strength and not itself responsible for the changes in the local energy); b) inspired to hard spheres interacting via elastic collisions and confined by fixed periodic obstacles (gas of geometrically constrained hard spheres). The above project entails the solution of major problems in the fields of Dynamical Systems and Probability. In addition, it would contribute to substantiate Boltzmann's theoretical picture by providing a conclusive rigorous example of non-equilibrium macroscopic behavior arising from an (interacting) microscopic mechanical model.

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**NBR: 246987** **ACRONYM: MARBIOTEC*EU-CN*** **EC FUND: 680400**

**DG:** REA **Call: FP7-PEOPLE-2009-IRSES** **Thema:** FP7-PEOPLE-2009-IRSES

**Title:** European-Chinese Research Staff Exchange Cluster on Marine Biotechnology

**Abstract:** Marine biotechnology is one of the most exciting emerging fields of technology. It becomes more and more important in many areas of application such as the production of new drugs, food ingredients, agrochemicals, and cosmetics. More recently, it was found that some products of marine organisms are also of extreme importance in the rapidly growing field of nano(bio)technology, another technology of the future. These developments have been recognized by the European Commission as well as by national funding organizations in Europe and in China, which included marine biotechnology and nano(bio)technology in their priority research programmes. Both the European Research Area (ERA) and China as one of the main players in the Asian-Pacific Research Area (APRA) are in the worldwide lead in marine biotechnology and nano(bio)technology regarding to the number of publications and patent applications. However, different sectors of these technologies are differently developed in Europe and China, suggesting that a combination of the complementary expertise in these sectors will be of benefit to both partners. The proposed international staff exchange programme is based on three institutions in Europe and four institutions in China (universities and research organizations including marine stations) with a number of top-ranked research groups in the field of marine biotechnology, drug discovery/natural products chemistry, biomineralization and material sciences / nanotechnology. The objective of the project is to create an efficient and successful programme for the transfer of knowledge between the partners by the exchange and training of staff (both early-stage researchers and experienced researchers) of the participating institutions. The goal is a lasting integration of the research capacities in the European Union and China in the multidisciplinary field of marine biotechnology/nano(bio)technology.

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**NBR: 247007** **ACRONYM: CACOMEL** **EC FUND: 153000**

**DG:** REA **Call: FP7-PEOPLE-2009-IRSES** **Thema:** FP7-PEOPLE-2009-IRSES

**Title:** Nano-carbon based components and materials for high frequency electronics

**Abstract:** A strong expansion of the frequency range towards terahertz and infrared is the major trend in the modern electronics and optoelectronics. It relies on the incorporation of modern nanotechnology that has already given the birth to nanoelectronics, a rapidly developing discipline focused on both the dramatic increase of the component integration level and decrease in a power consumption. Performance of nanoelectronic devices is strongly influenced by quantum effects that often even determine properties of nano-sized components. The project aims at understanding of fundamentals of the electromagnetic processes in nanocircuits, theoretical and experimental investigation of underlying mechanisms responsible for their fascinating properties, and development of physical basis for use of these properties in novel nanoelectronic devices. The project focuses on linear and nonlinear electromagnetic effects in nano-carbon structures, such as onion-like carbon and both single- and multi-wall carbon nanotubes. We will investigate in detail a performance of nanocircuits based on carbon nanotubes and

other nanocarbon materials. The multidisciplinary and challenging project relies on the complementary expertise of the consortium teams and is based on the original approach combining electrodynamics of mesoscopic inhomogeneous media and quantum theory of electronic ensembles with reduced dimensionality.

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**NBR: 247041** **ACRONYM: FUNCA** **EC FUND: 1658544**

**DG:** ERCEA **Call: ERC-2009-AdG** **Thema:** ERC-AG-PE5

**Title:** Functional Nanomaterials via Controlled Block Copolymer Assembly

**Abstract:** We outline an ambitious 5 year interdisplinary research programme that introduces a fundamentally new platform to the fabrication of nanoelectronic and liquid crystal devices, current areas of intense scientific and technological interest. The new approach involves the use of block copolymer micelles and block comicelles prepared by Crystallization-Driven Living Polymerization (CDLP) processes. This novel method allows unprecedented access to well-defined micelle architectures (with size control, narrow size distribution, and access to segmented structures that possess heterojunctions). Crosslinking will also be used to optimize micelle mechanical properties where necessary. The new platform offers very promising advantages over competitive methods for realising nanomaterials these include ambient temperature synthesis and solution processing, easy control of dimensions and aspect ratio, electronic properties, and semiconductor/semiconductor or semiconductor/dielectric junction fabrication. In addition, the use of hydrophilic coronas should, in principle, allow the self-assembly processes and subsequent manipulations to be performed in water.

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**NBR: 247072** **ACRONYM: NANOFORBIO** **EC FUND: 2499091**

**DG:** ERCEA **Call: ERC-2009-AdG** **Thema:** ERC-AG-PE3

**Title:** Nanostructures for biology

**Abstract:** I propose to employ our advanced capabilities for nanofabrication to explore new biology at the single-molecule and single-cell level. I choose to specifically address two directions of intense scientific interest: (i) With my team I will develop and exploit solid-state nanopores for the study of real-time translocation of individual biomolecules. In the past few years, my group has attained a leading position in this field and we want to apply our advanced knowledge to push the technology and use it to resolve some pressing questions in cell biology and biotechnology. Specifically, we will explore screening of DNA-protein complexes at the single-molecule level, and we will build biomimetic nanopores to address the physical mechanism of selection and controlled

molecular transport of the nuclear pore complex. (ii) We will use nanofabrication to create well-defined landscapes for bacteria. This will allow biophysical studies of the interaction between bacteria and their habitat with an unprecedented control of the spatial structure and habitat parameters. I strongly believe that this approach constitutes a major new tool to experimentally address a number of fundamental issues in the ecology and evolution of bacteria for the first time in a controlled environment. Additionally, it opens up a way to explore the biophysics of bacteria in confined space, where we will study a new bacterial phenotype in nanofabricated slits which we recently discovered. While this research is primarily driven by the quest for understanding physical mechanisms in biology, it can also be expected to have profound impact on applications in antibiotics, gene therapy, and DNA sequencing.

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**NBR: 247143** **ACRONYM: QUANTIF** **EC FUND: 2129141**

**DG:** ERCEA **Call: ERC-2009-AdG** **Thema:** ERC-AG-PE4

**Title:** Quantitative Multidimensional Imaging of Interfacial Fluxes

**Abstract:** Interfacial physicochemical processes are ubiquitous in chemistry, the life sciences and materials science, underpinning some of the most important scientific and technological challenges of the 21st century. The overarching aim of this proposal is to draw together separate strands of interfacial science by creating a unique holistic approach to the investigation of physicochemical processes and developing principles and methods which have cross-disciplinary application. To understand and optimise interfacial physicochemical processes, the major aspiration is to obtain high resolution pictures of chemical fluxes at a scale commensurate with our understanding of structure. The proposed research will address this need and break new ground by: (a) developing a family of innovative imaging methods capable of quantitatively visualising interfacial fluxes with unprecedented resolution that have wide application; and (b) establishing a common framework applicable to different fields of science through the usage of electrochemical principles. Experimental/instrumentation aspects will be supported by advanced modelling of mass transport-chemical reactivity. The research programme will focus on three distinct and important exemplar topics. (i) Electrochemical processes at new forms of carbon, including carbon nanotubes and graphene, where a major challenge is to identify the active sites for electron transfer. (ii) Membrane transport, where the goal is to identify the true factors controlling passive permeation across bilayer lipid membranes, with implications for understanding membrane function. (iii) Crystal growth/dissolution, where there is a major need to bridge kinetic and structural studies so as to understand the relationship between surface features and local flux. The project will allow a team of sufficient critical mass to be constituted to transfer knowledge between each area and establish a new way of addressing and understanding interfacial processes.

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**NBR: 247170** **ACRONYM: MICRONANO** **EC FUND: 2495982**

**DG:** ERCEA **Call: ERC-2009-AdG** **Thema:** ERC-AG-PE6

**Title:** Modeling Brain Circuitry using Scales Ranging from Micrometer to Nanometer

**Abstract:** If we are ever to unravel the mysteries of brain function at its most fundamental level, we will need a precise understanding of how its component neurons connect to each other. Furthermore, given the many recent advances in genetic engineering, viral targeting, and immunohistochemical labeling of specific cellular structures, there is a growing need for automated quantitative assessment of neuron morphology and connectivity. Electron microscopes can now provide the nanometer resolution that is needed to image synapses, and therefore connections, while Light Microscopes see at the micrometer resolution required to model the 3D structure of the dendritic network. Since both the arborescence and the connections are integral parts of the brain's wiring diagram, combining these two modalities is critically important. In fact, these microscopes now routinely produce high-resolution imagery in such large quantities that the bottleneck becomes automated processing and interpretation, which is needed for such data to be exploited to its full potential. We will therefore use our Computer Vision expertise to provide not only the necessary tools to process images acquired using a specific modality but also those required to create an integrated representation using all available modalities. This is a radical departure from earlier approaches to applying Computer Vision techniques in this field, which have tended to focus on narrow problems. State-of-the-art methods have not reached the level of reliability and integration that would allow automated processing and interpretation of the massive amounts of data that are required for a true leap of our understanding of how the brain works. In other words, we cannot yet exploit the full potential of our imaging technology and that is what we intend to change.

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**NBR: 247283** **ACRONYM: FLAMENANOMANUFACTURE** **EC FUND: 2500000**

**DG:** ERCEA **Call: ERC-2009-AdG** **Thema:** ERC-AG-PE8

**Title:** Flame Aerosol Reactors for Manufacturing of Surface-Functionalized Nanoscale Materials and Devices

**Abstract:** Nanotechnology research has been directed mostly to the design and synthesis of (a) materials with passive nanostructures (e.g. coatings, nanoparticles of organics, metals and ceramics) and (b) active devices with nanostructured materials (e.g. transistors, amplifiers, sensors, actuators etc). Little is known, however, about how well the unique

properties of nanostructured materials are reproduced during their large scale synthesis, and how such manufacturing can be designed and carried out. A key goal here is to fundamentally understand synthesis of surface-functionalized, nanostructured, multicomponent particles by flame aerosol reactors (a proven scalable technology for simple ceramic oxide nanopowders). That way technology for making such sophisticated materials would be developed systematically for their efficient manufacture so that active devices containing them can be made economically. Our focus is on understanding aerosol formation of layered solid or fractal-like nanostructures by developing quantitative process models and systematic comparison to experimental data. This understanding will be used to guide synthesis of challenging nanoparticle compositions and process scale-up with close attention to safe product handling and health effects. The ultimate goal of this research is to address the next frontier of this field, namely the assembling of high performance active devices made with such functionalized or layered nanoparticles. Here these devices include but not limited to (a) actuators containing layered single superparamagnetic nanoparticles and (b) ultraselective and highly sensitive sensors made with highly conductive but disperse nanoelectrode layers for detection of trace organic vapors in the human breath for early diagnosis of serious illnesses.

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**NBR: 247299** **ACRONYM: MOLART** **EC FUND: 2568000**

**DG:** ERCEA **Call: ERC-2009-AdG** **Thema:** ERC-AG-PE4

**Title:** Surface-Confined Metallosupramolecular Architecture: Towards a Novel Coordination Chemistry for the Design of Functional Nanosystems

**Abstract:** The fascinating properties of transition metal complexes intrigued generations of scientists and spurred major technological developments. They are decisive for life processes and catalysis. More recently the pertaining coordination interactions were used to assemble discrete nanostructures and supramolecular networks. Here we aim at a rationale for the design of metallosupramolecular architectures in intimate contact with solid supports. We study and control individual functional molecules and their metal-directed assembly at well-defined surfaces in exquisite detail by molecular-level scanning tunneling microscopy and spectroscopy. The atomistic insight gained into the underlying mechanisms and interactions is used to steer the formation of nano-architectures, whose physicochemical properties are characterized by local and space-averaging techniques. We rationalize the full involvement of the surface atomic lattice in the metal-ligand interactions and coordination spheres using advanced spectroscopic techniques and complementary ab initio theoretical calculations. We engineer nanoporous coordination networks with tailored cavities for patterning purposes, confinement and host-guest systems. We develop new concepts for controled molecular motion in nanoscale coordination environments. We explore the redox chemistry and catalytic activity of the presented coordinatively unsaturated sites to develop novel

single-site heterogenous catalysts and potentially biomimetic systems. It is suggested that with the described research a novel heading in coordination chemistry can be explored. The properties of metal centers in unique coordination environments challenge our current understanding, whereas their nanoscale control bears promise for distinct and tunable functionalities.

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**NBR: 247330** **ACRONYM: NANOANTENNAS** **EC FUND: 2499600**

**DG:** ERCEA **Call: ERC-2009-AdG** **Thema:** ERC-AG-PE3

**Title:** Nano-Optical Antennas for Tuneable Single Photon Super-Emitters

**Abstract:** Nano-optical antennas allow to confine light on a truly nanometer scale. Indeed, my group recently demonstrated efficient funneling of incident far field to antenna hotspots, i.e. nano-focusing down to 25 nm, and achieved for the first time steering of the angular photon emission of a single molecule. These pioneering results on close encounters between nano-antennas and photon emitters pave the way to a regime of new physical phenomena: super-emission, gradient effects, breakdown of the dipole approximation, near-field spectra, single photon beaming, quantized plasmons and potentially strong coupling. These are exactly the novel effects I plan to explore. Specific objectives are: - Nano-optical control: positioning of single photon emitters at antenna hotspots with < 10 nm accuracy by top-down fabrication, optical forces and chemical recognition. - Super-emission-focusing: boosting of emission to ps Rabi periods and unity quantum efficiency by resonant coupling to the nano-antenna. Photons will be beamed in an antenna dominated angular cone, which in reciprocity acts as the acceptance cone for super-focusing. - Coherent antenna control: by shaping the phase content of broad band fs pulses and tuning the antenna load by optically active materials, I will control nanoscale fields, both in the temporal and spatial domain. - Quantized plasmons: by coupling single photon emitters across a nano-antenna I will explore strong coupling and uncover the quantum nature of plasmons. This research aims for a profound understanding of the fundamental limits of optical control at the nanoscale. The new tuneable photon super-emitters and nano-hot-spots open several new horizons: controlled single photon sources for quantum-information; light harvesting; energy conversion; efficient bio-sensors; optical imaging with 10 nm resolution.

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**NBR: 247365** **ACRONYM: MAGIC** **EC FUND: 1800270**

**DG:** ERCEA **Call: ERC-2009-AdG** **Thema:** ERC-AG-PE5

**Title:** (Nano)-Materials for cell Growth, Imaging and Communication

**Abstract:** MaGIC intends to explore the use of nano/micro objects, in particular zeolite L, as materials for imaging, and, when the zeolites are used as substrates, for analyzing and manipulating cells. In particular in vivo and in vitro imaging, cell growth on nano/micro patterned zeolite monolayers, and understanding some of the processes of cell-to-cell communication are the ambitious goals of this proposal. We intend to achieve these goals through 5 objectives: 1. Synthesis and characterization of zeolites and loading and trapping of dye molecules. 2. Patterned zeolite monolayers and microcontact printing for asymmetric functionalization and cells transfer. 3. Molecular imaging using nanoporous materials as multiresponsive probes. 4. Cell growth, proliferation and stimulation of processes in spatially confined areas. 5. Communication between cells and cell differentiation. The project is extremely challenging and if successful will open new horizons in the use of nanomaterials in combination with living systems and will develop new technologies for handling delicate substrates and assemblies. The numerous ideas and problems that MaGIC addresses are of fundamental importance and collectively represent an interesting approach to simply mimicking nature, connecting biological components to abiotic materials in order to understand the mechanisms of the biological systems or to take advantage of the unique properties of the 'non-biological' components in a natural setting (in vivo and in vitro). The stepwise approach, starting from the use of the nanomaterials for observing the surrounding environment (cell imaging), and proceeding to their assembly in functional architectures, culminates in the realization of special interfaces with the ambition to realize and study cell-to-cell communication.

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**NBR: 247368** **ACRONYM: 3SPIN** **EC FUND: 2799995**

**DG:** ERCEA **Call: ERC-2009-AdG** **Thema:** ERC-AG-PE3

**Title:** Three Dimensional Spintronics

**Abstract:** Spintronics, in which both the spin and the charge of the electron are used, is one of the most exciting new disciplines to emerge from nanoscience. The 3SPIN project seeks to open a new research front within spintronics: namely 3-dimensional spintronics, in which magnetic nanostructures are formed into a 3-dimensional interacting network of unrivalled density and hence technological benefit. 3SPIN will explore early-stage science that could underpin 3-dimensional metallic spintronics. The thesis of the project is: that by careful control of the constituent nanostructure properties, a 3-dimensional medium can be created in which a large number of topological solitons can exist. Although hardly studied at all to date, these solitons should be stable at room temperature, extremely compact and easy to manipulate and propagate. This makes them potentially ideal candidates to form the basis of a new spintronics in which the soliton is the basic transport vector instead of electrical current. ¬3.5M of funding is requested to form a new team of 5 researchers who, over a period of 60 months, will perform computer simulations and experimental studies of solitons in 3-dimensional

networks of magnetic nanostructures and develop a laboratory demonstrator 3-dimensional memory device using solitons to represent and store data. A high performance electron beam lithography system (cost 1M¬) will be purchased to allow state-of-the-art magnetic nanostructures to be fabricated with perfect control over their magnetic properties, thus allowing the ideal conditions for solitons to be created and controllably manipulated. Outputs from the project will be a complete understanding of the properties of these new objects and a road map charting the next steps for research in the field.

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**NBR: 247375** **ACRONYM: TOSCA** **EC FUND: 2491989**

**DG:** ERCEA **Call: ERC-2009-AdG** **Thema:** ERC-AG-PE7

**Title:** Terahertz Optoelectronics - from the Science of Cascades to Applications

**Abstract:** Over the last 10 years, research in the terahertz (THz) frequency region of the electromagnetic spectrum has grown dramatically. The most significant development has been the demonstration of the first THz frequency quantum cascade laser (QCL) in 2002 by my EC FP-V consortium, WANTED. These advances have been accompanied by an equally important industrial applications-pull, with exploitation envisaged in the pharmaceutical and security sectors, for medical imaging and atmospheric sensing, and for high frequency electronics and communications. Yet, the enormous potential of the THz range has still to be unlocked, principally as there remains a lack of versatile, compact THz systems. My vision here is to address this, creating a step-change in the exploitation of THz technology. I will develop the patterning of periodic and aperiodic grating structures both lithographically, and for the first time, electronically, to engineer the photonic properties of THz QCLs. I will demonstrate the use of surface acoustic waves to modulate QCLs piezoelectrically, creating dynamically tunable sources. A continuous wave system-on-a-chip based on a QCL source, waveguide and integrated solid state detectors will be developed, together with an on-chip continuous-wave THz interferometer, and proven in the study of low-dimensional, nanostructured systems. I will develop a compact fibre-coupled broadband THz system, based on 1.55µm fs-laser excitation of photoconductive antennae. Investigations into the fundamental science underlying THz QCLs will include magnetic field gain measurements of THz QCLs to probe the role of non-Markovian transport in superlattice optoelectronic structures. This programme, comprising the symbiotic development of THz engineering and science, will be unique internationally and will open new opportunities and directions in the study and exploitation of THz frequency electronics and photonics.

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**NBR: 247384** **ACRONYM: SPINMOL** **EC FUND: 1679700**

**DG:** ERCEA **Call: ERC-2009-AdG** **Thema:** ERC-AG-PE5

**Title:** Magnetic Molecules and Hybrid Materials for Molecular Spintronics

**Abstract:** In this project we intend to design new magnetic molecules and new classes of magnetic molecular materials which, conveniently nanostructured, can be of interest in molecular spintronics, quantum computing and, in general, in nanomagnetism. The project pretends to cover either the development of molecule-based materials with interesting spintronic properties (molecule-based spintronics), as well as the design and study of magnetic molecules of interest in unimolecular spintronics and quantum computing. The objectives will be the following: - Use of molecule-based magnets for the preparation of multilayered spintronic structures (molecular spin valves) - Design of molecule-based magnetic materials exhibiting multifunctional properties (ferromagnetic superconductors, magnetic multilayers and magnetic/conducting multilayers) - Nanopatterning of magnetic nanostructures on surfaces via a molecular approach. - Chemical control of quantum spin dynamics and decoherence in single-molecule magnets based on magnetic polyoxometalates with the aim of developing qu-bits based on these inorganic molecules. - Positioning and addressing magnetic polyoxometalates on surfaces. An unconventional strategy of this project is the use of purely inorganic building blocks, as well as of inorganic magnetic molecules to design these magnetic materials, instead of using metal-organic molecular systems. This purely inorganic molecular building-block approach will benefit from the robustness of this kind of molecules and materials. Another characteristic feature of this project is the combination of top-down and bottom-up approaches for the processing of the molecules / materials. Thus, the project will exploit the advantage of using lithographic techniques (high throughput, easy scalability, etc.) in combination with the chemical bottom-up design of the molecular system, for the nanopatterning of the materials and the positioning of the molecules on surfaces with nanoscale accuracy.

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**NBR: 247401** **ACRONYM: MICRONANOTELEHAPTICS** **EC FUND: 3264188**

**DG:** ERCEA **Call: ERC-2009-AdG** **Thema:** ERC-AG-PE7

**Title:** Micro/Nano Exploration, Manipulation and Assembly: Telehaptics and Virtual Reality System Development and Investigation of Biomechanics and Neuroscience of Touch

**Abstract:** The primary objective of the proposed project is to develop robot mediated human interface technologies to manually explore, manipulate and assemble progressively smaller objects ranging from micro- to nano-meter scales and a secondary objective is to demonstrate the power of the interface system in the investigation of the fundamental mechanics and neural mechanisms of touch. The proposed system will consist of a master-slave robotic teleoperation (TO) subsystem and a virtual reality (VR) subsystem. The master robot will enable the user to touch, feel and manipulate (1) real micro/nano

structures through the slave robot or (2) computer models of micro/nano structures in the virtual reality environment. Specific aims of this effort are as follows: (1) design and develop a custom master system to enable the user to have real-time visual, auditory, and bimanual haptic interactions; (2) design and develop a slave system consisting of microscopes and manipulators progressively augmented to enable micro to nano-precision movements and forces; (3) develop modular software architecture with device abstraction to support multiple master and slave devices; (4) integrate virtual reality software to enable the user to have real-time visual, auditory, and bimanual interactions with virtual models at micro- to nano-meter scales based on empirical data or to test hypotheses; (5) use the system to perform biomechanics and neurophysiology experiments at progressively micro- to nano-precision movements and forces; (6) develop mathematical models of mechanotransduction for quantitative understanding of touch mechanisms at multiple scales.

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**NBR: 247404** **ACRONYM: MESOLIGHT** **EC FUND: 2046000**

**DG:** ERCEA **Call: ERC-2009-AdG** **Thema:** ERC-AG-ID1

**Title:** Mesoscopic Junctions for Light Energy Harvesting and Conversion

**Abstract:** Research will focus on the generation of electric power by mesoscopic solar cells, a domain where the PI has an outstanding track record and leadership on the global scale. The target is to increase the photovoltaic conversion efficiency from currently 11 to over 15 percent rendering these new solar cells very attractive for applications in large areas of photovoltaic electricity production. The approach to reach this challenging target is highly creative and has a strongly interdisciplinary character. Successful implementation of the project goals is assured by the vast experience and know how of the PI and his team in the key areas of the project. The project is divided in four work packages. The first three introduce creative new concepts to enhance substantially the performance of single-junction dye sensitized nanocrystalline devices, while the fourth addresses multi-junction cells and photon up-conversion systems. The tasks to be accomplished comprise 1) The theoretically assisted conception and synthesis of new molecular sensitizers to extend the spectral response of dye sensitized photovoltaic cells into the near IR up to 900 nm, increasing substantially the short circuit photocurrent of the solar cell. 2) The implementation of highly innovative mesoscopic oxides structures to support the molecular dye or quantum dot and collect the photo-generated charge carriers. 3) The introduction of smart amphiphilic molecular insulators and ultra-thin ceramic barriers at the mesoscopic junction in order to retard the interfacial electron-hole recombination and 4) The exploration of radically new cell embodiments based on multi-junction tandem cells and photon up-conversion schemes, whose solar to electric power conversion efficiency can be raised beyond the Shockley-Queiser limit of 32 percent.

**NBR: 247452** **ACRONYM: ATOMAG** **EC FUND: 2492561**

**DG:** ERCEA **Call: ERC-2009-AdG** **Thema:** ERC-AG-PE3

**Title:** From Attosecond Magnetism towards Ultrafast Spin Photonics

**Abstract:** We propose to investigate a new frontier in Physics: the study of Magnetic systems using attosecond laser pulses. The main disciplines concerned are: Ultrafast laser sciences, Magnetism and Spin-Photonics, Relativistic Quantum Electrodynamics. Three issues of modern magnetism are addressed. 1. How fast can one modify and control the magnetization of a magnetic system ? 2. What is the role and essence of the coherent interaction between light and spins ? 3. How far spin-photonics can bring us to the real world of data acquisition and storage ? - We want first to provide solid ground experiments, unravelling the mechanisms involved in the demagnetization induced by laser pulses in a variety of magnetic materials (ferromagnetic nanostructures, aggregates and molecular magnets). We will explore the ultrafast magnetization dynamics of magnets using an attosecond laser source. - Second we want to explore how the photon field interacts with the spins. We will investigate the dynamical regime when the potential of the atoms is dressed by the Coulomb potential induced by the laser field. A strong support from the relativistic Quantum Electro-Dynamics is necessary towards that goal. - Third, even though our general approach is fundamental, we want to provide a benchmark of what is realistically possible in ultrafast spin-photonics, breaking the conventional thought that spin photonics is hard to implement at the application level. We will realize ultimate devices combining magneto-optical microscopy with the conventional magnetic recording. This new field will raise the interest of a number of competitive laboratories at the international level. Due to the overlapping disciplines the project also carries a large amount of educational impact both fundamental and applied.

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**NBR: 247462** **ACRONYM: QUOWSS** **EC FUND: 2500000**

**DG:** ERCEA **Call: ERC-2009-AdG** **Thema:** ERC-AG-PE2

**Title:** Quantum Optics in Wavelength Scale Structures

**Abstract:** In this project I will investigate the interaction between quantum light and matter in optical structures that are at or below the wavelength scale. Such devices could provide unprecedented performance in the storage of data, the switching of light and the generation of light of tailored properties. I will address this topic through the study of 2-level systems (quantum dots, N-V centres, atoms), and non-linear materials (Ç(2) ,Ç(3) )

in various nanoscale dielectric and conducting structures. This will include: " quasi 1D systems such as pillar microcavities, " 2D systems such as microstructured fibres and suspended waveguide photonic bandgap cavities " 3D systems such as single particle assembled 3D nano-cavities I will design suitable systems using the wide suite of electromagnetic modelling softwares available in my group. This will also involve the inclusion of the allowed modes and their interaction with single two-level quantum systems and non-linear materials.

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**NBR: 247518** **ACRONYM: ONDA** **EC FUND: 201600**

**DG:** REA **Call: FP7-PEOPLE-2009-IRSES** **Thema:** FP7-PEOPLE-2009-IRSES

**Title:** Ordered hetero- and Nano-structures with Epitaxial Dielectrics for magnetic and electronics Applications

**Abstract:** Present project aims at strengthening the research cooperation between EU and Russia in the strategic field of ultrathin nanostructured dielectric materials for advanced electronic applications. This field is experiencing a continuous expansion, due to the wide possible applications, which include, among others, enhanced-performance data storage devices, catalysis, communication technologies, sensoristics and molecular electronics. Russia is a leading country in frontier research in this highly relevant technological area, and we believe that through this project the role of EU can be highly reinforced. This will be achieved through the joint participation of EU and Russian researchers in common experiments and related activities. The exchange programme will involve 7 independent partners, 5 located in EU and 2 in Russia and will have the duration of 4 years. The different partners are: 1. UNIMORE – University of Modena and Reggio Emilia (Italy) - project coordinator 2. INC – Institut Català de Nanotecnologia (Spain) 3. IMDEA – Nanociencia (Spain) 4. ESRF – European Synchrotron Radiation facility (France) 5. ILL – Institut Laue Langevin (France) 6. IOFFE – Ioffe Physical-Technical Institute, St. Petersburg (Russia) 7. PNPI – Petersburg Nuclear Physics Institute (Russia) The exchange will concern: i) the preparation and conduction of joint experiments; ii) the discussion of the results; iii) the transfer of knowledge between partners, in relation to specific expertise of individual partners; iv) the periodic organization of workshops and seminars to present the results and identify future activities - common strategies; v) the training of technical staff and researchers; vi) the creation of a research network between EU participating countries and Russian institutions in the field of the experimental investigation of hetero- and ordered nano-structures on dielectrics; vii) dissemination of the results not only within the network but also outside.

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**NBR: 247524** **ACRONYM: NANOCOM-NETWORK** **EC FUND: 99000**

**DG:** REA **Call: FP7-PEOPLE-2009-IRSES** **Thema:** FP7-PEOPLE-2009-IRSES

**Title:** Advanced Processing and Characterisation of Micro and Nano Composites

**Abstract:** "NanoCom-Network" is composed by 2 Universities in Europe (Universität des Saarlandes, Germany; and Technische Universität Wien, Austria), 1 Research Center (Helmholtz Zentrum Berlin, Germany) and 4 Institutions in Latinamerica (Centro Atómico Bariloche and Universidad Nacional de Río Cuarto, Argentina, Universidade de Sao Pualo, Universidad de Concepción, Chile) who will cooperate in the Advanced Processing and Characterisation of Micro and Nano Composites. The purpose of the network is to combine the different thematic specialties of different experts in the multidisciplinary field of materials science in order to design new composite materials with superior properties and performance. To achieve this goal it is necessary to develop in parallel new characterization techniques, especially for the 3D imaging and analysis of the material architecture. Techniques like Focused Ion Beam Tomography, x-Ray (including synchrotron) tomography and Atome Probe Tomography will be applied and further developed for the study of composite materials. In particular, Nickel reinforced with Carbon Nanotubes for electrical applications, Al-based Metal Matrix Composites for structural applications and Nanocomposites with nanostructured coatings for application in manufacturing technologies will be studied. 39 exchanges with the participation of 28 scientists with different level of experience (from PhD students till professors) will be carried out within the project. There is a particular good balance of experience levels among the participant universities as well as a balanced distribution of exchanges among the partners. The total amount of the project is 99.000 €. Two workshops will be organized in order to exchange experience among the partners, to enhance the transfer of knowledge as well as to discuss further common activities.

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**NBR: 247532** **ACRONYM: MULTIWAVES** **EC FUND: 351000**

**DG:** REA **Call: FP7-PEOPLE-2009-IRSES** **Thema:** FP7-PEOPLE-2009-IRSES

**Title:** Multiband Electronically Reconfigurable Microwave Devices and Antennas for a New Generation of Wireless Systems

**Abstract:** This project aims at establishing new partnerships and reinforcing already existing ones between two European and three non-European research institutions, through a structured programme of exchange of researchers and coordinated multiannual joint research programme in the field of multiband electronically reconfigurable microwave devices and antennas. The participating institutions from Serbia, United Kingdom, Russia, South Africa and USA, chosen for the diversity in their respective expertise and research approaches, are recognized world-wide as leaders in research and innovation. The wide scope and depth of the knowledge accumulated in the consortium offers a unique opportunity for exchanged researchers to undertake cutting-edge research

under mentorship of experienced senior researchers. The main technical goal of the joint research programme is to encourage the application of emerging technologies and result in the development of low-cost miniature tunable and reconfigurable microwave devices and antennas for future multifunctional wireless systems. Main research targets are: - Development of compact microwave devices and antennas with multiple functionalities, - Development and applications of novel artificially structured materials like metamaterials, controllable electromagnetic band gap materials, nano-foam materials and reconfigurable metamaterials, - Applications of fractal curves in the design of compact and multiband devices due to their inherent multimode operation, - Development of computationally efficient electromagnetic analysis and optimization tools for multiband reconfigurable devices, - Development of low-cost microfabrication techniques using multi-layer technology (LTCC and Thick-Film), ferroelectrics and superconducting technologies.

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**NBR: 247540** **ACRONYM: X-MOTION** **EC FUND: 270000**

**DG:** REA **Call: FP7-PEOPLE-2009-IRSES** **Thema:** FP7-PEOPLE-2009-IRSES

**Title:** Exploring nanoscale motion and molecular alignment using ultrafast coherent diffraction

**Abstract:** Single particle imaging requires that identical objects would be successively exposed to powerful coherent X-ray pulses, and diffraction `snapshots' collected at unknown object orientations. However determining the orientations of the individual low-signal diffraction patterns and hence reconstructing the diffraction volume require much more signal than available. To circumvent the difficulty, we propose in X-Motion to orient a single molecule or nanoparticle to improve the diffracted signal and to achieve a 3-D reconstruction. Azobenzene derived polymers (AZOs) motion could be used to align the system. Practically, the isomerization of an azobenzene chromophore induces a large molecular length change that is well suited to power and actuate nanoscale or molecular motions. Our project proposes to use AZOs properties to manipulate and align other systems like single nanorods or isolated molecules (proteins for example). We will use ultrafast coherent X-ray diffraction in a pump-probe scheme to follow in real time the isomerization induced alignment. X-Motion network will gather experimentalists and theoreticians from France, Germany, and the United States, all interested in imaging individual particles and molecules using state of the art soft and hard X-ray coherent sources. The partners have competency in ultrafast coherent imaging, nanoscale fabrication, chemistry (polymers, femtochemistry, aerosols), X-ray spectroscopy and theoretical calculations. This synergy between these domains is essential to address the issue of single particle alignment and imaging. X-Motion will involve FLASH soft X-ray free electron laser facility in Hamburg (Germany), LCLS at Stanford (USA), 3rd generation ALS synchrotron at Berkeley (USA) and table-top ultrafast laser harmonic in CEA Saclay near Paris (France). This will give access to a wide range of photon energies and pulse duration.

**NBR: 247542** **ACRONYM: NANOSIRNA** **EC FUND: 48600**

**DG:** REA **Call: FP7-PEOPLE-2009-IRSES** **Thema:** FP7-PEOPLE-2009-IRSES

**Title:** Transfection Ability and Intracellular Pathway of LbL Nanostructured siRNA Delivery Systems.

**Abstract:** The scientific objective of the research carried out in this International Research Staff Exchange Scheme, is the development of a new technology to effectively deliver siRNA to cancer cells by the embedding of a polyplex into the multilayers and multifunctional nanocapsules. We propose to target pro-survival and anti-apoptotic factors in human cancer cells by using siRNA encapsulated into polyelectrolytes nanocapsules.When siRNAs are formulated into degradable polymer nanocapsules they may be protected from nuclease digestion and last longer than naked siRNAs improving their efficacy and therapeutical properties. These capsules will be prepared by the LbL deposition of interacting polymers onto a sacrificial porous colloidal template followed by core removal. Nanoengineered micro-nanocapsules composed of sequentially assembled polymer layers hold immense promise for a variety of biomedical applications. Furthermore the optimization of intracellular pathway of nanostructures may likely be a key for the development of effective nanoparticles based targeted therapeutics. As the challenge of siRNA delivery by nanocapsules is met, it will be possible to advance RNAi therapeutics rapidly into clinical studies for many diseases, including some which remain untreatable or poorly treated by conventional drugs.

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**NBR: 247544** **ACRONYM: BIOMOLEC** **EC FUND: 349200**

**DG:** REA **Call: FP7-PEOPLE-2009-IRSES** **Thema:** FP7-PEOPLE-2009-IRSES

**Title:** Functionalized biopolymers for application in molecular electronics and in photonics

**Abstract:** The project will unite efforts of leading laboratories of 5 countries: France, Romania, Poland, Brazil and Russia to render the two well known biopolymers: DNA and collagen applicable in molecular electronics and in Photonics Marine DNA, extracted from waste in salmon industry and commercial collagen will be used to obtain biodegradable photoresponsive materials for application in photonics and in molecular electronics.Biodegradable and coming from renewlable ressources pure DNA and collagen, well known biopolymers, are chacterized by an ionic electrical conductivity and photoinactive large transparency range material. These materials will be functionalized with photoactive chromophores such as 1D charge transfer molecules to render them photoresponsive. On the other hand doping with such molecules as PEDOT, fullerenes

and particularly the nanotubes will increase significantly the charge mobility and make the biopolymers applicable in optical signal processing, molecular electronics and solar energy conversion. At the output of the project materials with controllable charge mobility and nonlinar optical response will be obtained. Practical applications, particularly in solar energy conversion and in making smart windows will be demonstrated

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**NBR: 247547** **ACRONYM: MEAD-ET** **EC FUND: 113400**

**DG:** REA **Call: FP7-PEOPLE-2009-IRSES** **Thema:** FP7-PEOPLE-2009-IRSES

**Title:** Novel medical adsorbents for extracorporeal treatment of life threatening conditions.

**Abstract:** Recently a program of development of super active carbonic adsorbents for the deep purification of whole blood and blood plasma was realised in the series of joint projects between The EU partners and Ukraine. As a result, nanostructured activated carbons with mass-fractal internal structure and unique capacity towards tightly protein-bound toxins, uncoated or coated with albumin conformers have been synthesized. These materials have been tested and approved for clinical use in Ukraine and Uzbekistan expressly for the treatment of severe hepatic insufficiency, renal insufficiency and multi-organ failure. The goal of this project is the transfer of these findings to a new version of nanostructured carbon, synthesized on the base of phenol-formaldehyde resin modified and coated with haemocompatible dextrans and its sulfated derivates in the Department of Physico-Chemical Mechanisms of Adsorptive Detoxification in the Institute of Experimental Pathology, Oncology and Radiobiology Nat. Acad. of Sci of Ukraine and studied in the School of Pharmacy and Biomolecular Sciences at the University of Brighton (biocompatibility, inflammatory mediator adsorption) and the Laboratory of Immunology, School of Medicine and Pharmacy, University of Clermont-Ferrand (investigation of immunoadsorptive properties of nanostructured carbonic adsorbents coated with sulfated polysaccharides). This program gives the opportunity to cultivate a high scientific quality consortium consisting of 2 European and 1 third country academic institute, with the aim to sustain and create new collaborative partnerships between EU partners and Ukraine, and transfer knowledge and technologies in one of the most exciting fields of modern biomaterial science. Focusing on the development of extracorporeal methods for toxin removal, for the treatment of many life threatening conditions and chronic conditions, that result in a low quality of patient life.

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**NBR: 247579** **ACRONYM: NANOLICOM** **EC FUND: 189000**

**DG:** REA **Call: FP7-PEOPLE-2009-IRSES** **Thema:** FP7-PEOPLE-2009-IRSES

**Title:** Nanostructured Lithium Conducting Materials

**Abstract:** Solid State Ionics, as an interdisciplinary science, covers chemistry, physics and materials science. The applied perspectives, that include high-energy-density batteries, fuel cells, electrolysis cells, chemical sensors, electrochromic devices and solar cells, and the need for their improvements are an important catalyst for designing new materials. Besides these attractive applications, academic research needs to be reinforced since ion transport in disordered materials is still poorly understood. In particular, the study of nanomaterials opens new questions related to the relationship between structure, processing and physical properties.The aim of this exchange program lies on the investigation of (i) the grain size effect and (ii) the crystallinity on ionic transport of Li-conducting materials based on perovskites, compounds with Nasicon structure and LiPON. Amorphous, nanocrystalline and microcrystalline oxides and oxynitride will be synthesized as powders and films. Processing of these materials and sintering will be performed to obtain thick films and high density pellets. Influence of micro and nanostructure on Li mobility will be investigated. TEM, SEM could offer a wealth of information on nanostructured compounds. Systematic investigations performed on these materials, using different dynamic techniques, able to probe static and dynamic properties at the microscopic level, will be useful, i.e. Nuclear Magnetic Resonance on 6Li and 7Li nuclei (with their different techniques: static NMR, MAS-NMR, 2D NMR, Pulse Field Gradient), quasi-elastic neutron scattering, broadband impedance and dielectric spectroscopy. In particular, the relationship between structure and physical properties will be clarified to lead to a rational design of ionic conductors and to an improvement of the electrochemical devices. A strong network between complementary scientists (Chemists, Physicists, Materials Engineers) from EU and Ukraine would be valuable to perform this programme.

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**NBR: 247599** **ACRONYM: ABREM** **EC FUND: 635400**

**DG:** REA **Call: FP7-PEOPLE-2009-IRSES** **Thema:** FP7-PEOPLE-2009-IRSES

**Title:** Advanced Biomaterials for Regenerative Medicine

**Abstract:** The main aim of this project is to establish a long-lasting collaboration and create a network of European and Chinese research centres of excellence and R&D active SMEs in the area of biomedical materials. This aim will be achieved by undertaking joint research activities in creating advanced composite 'hard' and 'soft' biomedical materials for regenerative medicine via collaboration facilitated by individual mobility of researchers between Europe and China. The main research objectives of the proposal are: - To synthesise novel composite carbon/carbon, carbon/polymer, polymer/polymer, carbon/ ceramic nanostructured biomaterials for advanced applications in regenerative

medicine; - To characterise mechanical, physical and chemical properties of the synthesised biomaterials; - To produce bioactive materials which have bispecific surface functional groups, bioactive coating, carry bioactive agents, or carry induced pluripotent stem cells; - To assess their biological performance in clinically reflective tests; - To develop technologies for manufacturing novel biomaterials; - To gain fundamental knowledge of the mechanism of biomaterial – biological media interactions; - To develop novel biosensor devices for monitoring tissue engineered constructs; - To establish routes to market for the materials developed in this project.

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**NBR: 247635** **ACRONYM: E-FLAG** **EC FUND: 75600**

**DG:** REA **Call: FP7-PEOPLE-2009-IRSES** **Thema:** FP7-PEOPLE-2009-IRSES

**Title:** Exchanges around Femtosecond Laser Applications in Glasses

**Abstract:** The concept is to collect the best researchers on the topic of the interaction of femtosecond laser with glasses for discussion and exchanges. On the other hand, it is to train students and young researchers on one of the most promising new research field which is the 3D local shaping of linear and non linear optical properties in glasses; the knowledge of the expert being shared with the novices. The development of femtosecond laser has prompted the investigation of many nonlinear physical phenomena, such as multiphoton induced reactions, plasma formation and avalanche ionisation in glasses. Today's ultrafast laser systems offer thus a myriad of material interactions such as 3D refractive index change internal patterning, annealing and micromachining but now other properties are aroused like oxydoreduction, chirality, non-reciprocal writing, self-assembled sub-wavelength structures, nanocluster structuration. These interactions exhibit enormous potentialities in the development of a new generation of components for photonics, optical telecommunication and high power laser. No other technique holds such potential for 3D shaping the linear and non-linear optical properties of optical glasses on demand and thus to realize 3D multi-component photonic devices, fabricated in one single step in a variety of transparent materials. All these qualities let us foresee a considerable and innovative development of the femtosecond laser writing technology in glasses. It is obvious that this new technology will be a source of employment in the next 10 years. We can thus predict a need of knowledge exchange and personnel training. Strength of scientific exchanges has thus to be increased in this research area. In the course of this, consistent views can be produced on the fundamental process for fostering new developments. In the same time, we can expect render easier applications already identify but also stimulate the creation of new original devices and new functions.

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**NBR: 247641** **ACRONYM: MICROCARE** **EC FUND: 669600**

**DG:** REA **Call: FP7-PEOPLE-2009-IRSES** **Thema:** FP7-PEOPLE-2009-IRSES

**Title:** Microsystems and Bioanalysis Platforms for Health Care MICROCARE

**Abstract:** Microsystems and Bioanalysis Platforms for Health Care - MICROCARE Miniaturisation of analytical systems is generally considered to be the strategy that will overcome the requirements of process speed for performing efficient evaluation studies. By utilising the versatility of silicon micromachining to fabricate efficient minute volume microstructures, it is possible to make analysis systems that are extremely small. The benefits of miniaturisation stem from the increased reaction kinetics in low volumes and the possibility to perform sample-handling procedures at a high speeds. Our research proposal is focussed on the implementation of micro/nano fabrication technologies for functionalised systems and sensors for bio-chemical analysis and micro delivery based on microtransducer array and micromachined modules. We propose to develop microfluidic devices, surface structuring and chemical organization methods to study both synthetic and systems biology. Additionally MEMS based devices will be developed for applications in life science research. The purpose is to form a network with the following aims: 1) to exploit synergies and complementarities (expertise and facilities) within the multidisciplinary partnership, through researcher mobilization, to conduct a focused research in life science 2) to address some of the theoretical and technological challenges, e.g. static and kinetic analyses with single molecular and cellular resolution and high throughput capabilities, 3) to use micro and nano techniques to develop appropriate systems and platforms to facilitate the defined research 4) develop a set of MEMs based devices for biomedical applications and 5) create a research climate within the partnership for long term collaboration between EU and China in this particular field. Investigations will be conducted through a collaborative process facilitated by a balanced exchange of researchers within the consortium.

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**NBR: 247644** **ACRONYM: LASERNAMI** **EC FUND: 347400**

**DG:** REA **Call: FP7-PEOPLE-2009-IRSES** **Thema:** FP7-PEOPLE-2009-IRSES

**Title:** Laser Nanoscale Manufacturing

**Abstract:** The project “Laser Nanoscale Manufacturing (LaserNaMi)” focuses on staff exchanging between the partners, especially between the partners of EU and China, on researching and developing new maskless laser nanoscale manufacturing technologies for low cost, simple and high speed manufacturing of nano structured surfaces and components including periodic structures (nano gratings, anti-counterfeiting security markers, nanoimprint templates, self-cleaning and antireflection surface nano-structures) and other arbitrary features. LaserNaMi has the following objectives : (1) To exchange ideas and technology concepts to further development on the new maskless laser nanoscale

manufacturing technologies. (2) To complement fabrication and characterization technologies with other technologies of partners in the LaserNaMi consortium to produce nanostructures in thin-films. (3) To explore novel applications for the laser nanoscale manufacturing from the combination of the different backgrounds and disciplines of the partners of LaserNaMi. (4) To strengthen research partnerships through staff exchanges and networking activities between European research organisations and organisations from China. (5) To establish long-term research cooperation through the proposed coordinated joint programme of exchange of researchers for short periods during the project. LaserNaMi meets the objectives and requirements of the Marie Curie Action: International Research Staff Exchange Scheme (IRSES), and it will provide support to the consortium members to establish and reinforce long-term research cooperation in laser nanoscale manufacturing through a coordinated joint programme of exchange of researchers.

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**NBR: 247656** **ACRONYM: TRASNADE** **EC FUND: 306000**

**DG:** REA **Call: FP7-PEOPLE-2009-IRSES** **Thema:** FP7-PEOPLE-2009-IRSES

**Title:** Transport studies on polymer based nanodevices and assemblies for delivery and sensing

**Abstract:** TRANSNADE is designated for the study of the transport properties of nanoscale assemblies and devices fabricated from polymers and polyelectrolytes, such as polyelectrolyte multilayers, polyelectrolyte brushes, polymer micelles, and polymersomes. Transport properties are fundamental for the rational design of delivery devices since the mechanism of transport will finally define release properties. For most of the mentioned nanodevices, transport properties are adjusted in an empirical way. A deeper understanding of the underlying principles and mechanisms of transport of matter is highly desirable. Polymer nanoassemblies in aqueous environments are heterogeneous and at least partly random systems. A complex scenario of interactions for the diffusing species with the nanomaterial can be expected resulting in unusual transport properties. Measuring transport properties at the nanoscale requires novel experimental and theoretical approaches. A multidisciplinary approach is needed, ranging from synthesis, self assembly, to physical chemistry and theoretical physics. TRANSNADE is formed by an international team with the required and complementary expertise. The expertise of Prof. Gao, from Zhejian University , in synthetic chemistry and self assembly together with the expertise of Dr. Moya, from CIC biomaGUNE, in materials science will be paramount for the creation of polymer with specific functions to be integrated on devices and assemblies. Prof. Donath from the University of Leipzig will develop a novel reaction-diffusion approach for diffusion measurements in nanoassemblies. Electrochemical measurements of transport will be performed by Dr.O.Azzaroni, from INIFTA and Dr.Moya will focus on solvent transport by designing an optical setup combined with QCM. Prof.V.Arakelyan from the Yerevan State University

and Prof. Donath will join together their expertise in theoretical and soft matter physics to model experimental data and establish a mechanism for transport.

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**NBR: 247659** **ACRONYM: TEMADEP** **EC FUND: 104400**

**DG:** REA **Call: FP7-PEOPLE-2009-IRSES** **Thema:** FP7-PEOPLE-2009-IRSES

**Title:** TEMPLATE-ASSISTED DEPOSITION OF FUNCTIONAL MATERIALS AND DEVICES

**Abstract:** Template-based deposition for the synthesis of nanowires and nanotubes is extensively reported for metals, alloys, and semiconductors. Properties and possible applications of such nanostructured materials were investigated to some extent; inclusive by parties cooperating in this project, but there is still a large need for an ample scientific study in order to support a future implementation in the European industry. This multidisciplinary project comprises research activities in electrochemistry, materials science, surface technology, film/nanostructures characterization, tribology, and corrosion science, and includes the electrodeposition, structural, mechanical, morphological characterization of deposits, corrosion and wear protection. The low cost electrodeposition of the following alloys is of interest in this project, namely alloys containing iron group metals, tungsten-containing iron group alloys, Mo-Ni alloys. Taking into account the large potential of such procedures for the electroforming of nanostructures and MEMS, the objective of this project is to intensify research activities to select and to improve existing procedures and plating bath formulations to deposit nanocrystalline films with a roughness equal or less than the roughness of the substrates. The films/coatings must posses pre-specified structural, mechanical, tribological, and chemical properties that are necessary to apply them in electroformed nanostructures such as nanowires/nanotubes, and in MEMS. Mapping of tribological, thermal, magnetic and corrosion behavior of films/coatings and nanowires/nanotubes, and MEMS will perform. The market potential of obtained results will analyze.

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**NBR: 247671** **ACRONYM: CANIOC** **EC FUND: 90000**

**DG:** REA **Call: FP7-PEOPLE-2009-IRSES** **Thema:** FP7-PEOPLE-2009-IRSES

**Title:** Chemical bonding and aromaticity in novel inorganic and organometallic clusters

**Abstract:** Clusters behave as a link between the atom and the bulk material. They exhibit characteristics of both forms of matter, depending on their size and their molecular and electronic structures. Such molecules can be potentially useful for technical applications as specific and very efficient catalysts, drugs, and other novel materials with as yet unimagined properties. As an example, the continued miniaturization of electronic

devices is pushing towards the nano- and molecular scales. In this sense, silicon clusters can be very important in the future development of the electronic industry. Other clusters are expected to have relevant catalytic or magnetic properties. All-metal and semi-metal clusters have been recently discovered. The unusual stability of all these clusters comes from their aromatic character. Indeed, the aromaticity is a key property of these compounds since it explains their stability and reactivity. As compared to the classical aromatic organic molecules, that possess only π-electron delocalization, the aromaticity in inorganic clusters is more complex. These compounds have σ- and π- (or even δ-) electron delocalization, thus giving rise to the so-called multifold aromaticity. All-metal and semimetal aromatic clusters represent one of the "new frontiers" of chemistry (the first of such clusters was discovered in 2001). It is expected that understanding the origin of aromaticity in these systems will help us to comprehend the factors that govern structural patterns and stability in solids. In addition, these novel materials are expected to have as-yet unimagined properties such as, for instance, nanodevices, intense non linear optical properties, high catalytic power and efficiency, and utility as possible drugs.

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**NBR: 247687** **ACRONYM: AQUTE** **EC FUND: 5575000**

**DG:** CNECT **Call: FP7-ICT-2009-4** **Thema:** ICT-2009.8.2

**Title:** Atomic QUantum TEchnologies

**Abstract:** The overall objectives of the AQUTE project are A) To develop quantum technologies based on atomic, molecular and optical (AMO) systems for * scalable quantum computation; * entanglement-enabled technologies like metrology and sensing. B) To establish and exploit new interdisciplinary connections, coming from AMO physics, but also including concepts and experimental settings of solid state systems, in order to * reinforce interdisciplinary links at the frontiers of quantum information science, and other fields of physics or science in general; * conceive and realize novel hybrid systems that couple in a coherent way physically different quantum degrees of freedom. Obj. A will be pursued along two complementary directions: * a bottom-up approach, where individually trapped atomic particles are combined into elementary general-purpose quantum processors including qubit interconnects; * a top-down approach, where many-particle atomic systems are employed to realize special-purpose quantum processors, for instance quantum simulators. Groundbreaking work in qualitatively new directions is also needed to lay the foundations for the future attainment of scalable fault-tolerant architectures. AQUTE will thus also * investigate new experimental systems that have become available in the laboratory and are of direct relevance for QIFT; * optimize existing and develop novel theoretical concepts for quantum processing. Obj. B connects atomic quantum technologies for QIFT to a wider context, by * exploring hybrid approaches to QIFT beyond AMO physics; * improving connections between QIFT and science in general, following the emergence of a new quantum

paradigm at the frontier of nanosciences and information sciences. These research lines determine the structuring of the AQUTE workplan into four deeply interrelated Sub-Projects: Entangling gates and quantum processors, Hybrid quantum systems and interconnects, Quantum Simulators and Quantum Technologies.

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**NBR: 247705** **ACRONYM: MESOPHYSDEF** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2009-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Mesoscopic framework for modeling physical processes in multiphase materials with defects

**Abstract:** Mesoscopic description of physical processes in structural materials is one of the most challenging aspects of understanding their behavior as it is the regime where atomic length scales merge with those of the continuum. It is the least understood regime compared to the atomic and continuum scales because the simplifications and advantages of theory in handling small/large length scales and fast/slow time scales no longer apply. One of the most challenging problems that has not been solved to date is how correlated defect domains affect the microstructure on the mesoscale and thus also the physical properties of materials. This problem will be solved by combining the classical Landau theory of phase transitions with the seminal 1958 work of Kröner in which dislocations are viewed as sources of incompatibility of elastic strains. The coupling of the microstructure with the incompatibility of strains will give rise to a new framework for the study of such mesoscale phenomena. In this formalism point defects will reduce to a simpler case as their fields are irrotational and thus do not contribute to the incompatibility of strains. The mesoscopic framework that will be developed in this project will contribute significantly to bridging of the so-called micron gap in the description of physical processes in crystalline materials. The role of defects, interfaces and microstructure is at the heart of understanding materials from nanometers to microns and the unique approach proposed here will address this issue. Implementing this theory will yield a mesoscopic computational tool for solving the inverse problem - designing novel materials with prescribed properties, such as resistance to fatigue and radiation damage.

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**NBR: 247739** **ACRONYM: NANOFATE** **EC FUND: 2497100**

**DG:** RTD **Call: FP7-NMP-ENV-2009** **Thema:** NMP-2009-1.3-1

**Title:** Nanoparticle Fate Assessment and Toxicity in the Environment

**Abstract:** Concept: NanoFATE has been conceived to fill knowledge and methodological gaps currently impeding sound assessment of environmental risks posed by engineered nanoparticles (ENPs). Our vision is to assess environmental fate and risk of ENPs from high-volume products for which recycling is not an option; namely; fuel additive, personal care and antibacterial products. Two market ENPs from each product (CeO2, ZnO, Ag of varying size, surface and core chemistries) will be followed through their post-production life cycles i.e. from environmental entry as "spent product", through waste treatment to their final fates and potential toxic effects. This will test the applicability of current fate and risk assessment methods and identify improvements required for a scientific assessment of ENPs at an early stage. Objectives: Such systematic study of the environmental fate and toxicity of selected ENPs will entail addressing 9 S&T objectives: 1: Design, tagging and manufacture of ENPs 2: Analysis of ENP interactions with abiotic and biotic entities 3: Generating predictive models for ENP exposure in waters and sludge-amended soils 4: Studying the fate and behaviour of ENPs through wastewater treatment 5: Determining acute and chronic ecotoxicity 6: Assessing effects of physico-chemical properties on ENP bioavailability 7: Defining mechanisms of uptake, internal trafficking, and toxicity 8: Developing spatial RA model(s) 9: Improving understanding of ENP risks Methodology: The work plan is designed to progress beyond the state-of-the-art through focused workpackages. While some objectives are delivered in single WPs, good cross WP integration will secure the key objectives of delivering new methods for quantifying ENP risks. Impact: NanoFATE will provide robust tools, techniques and knowledge needed by stakeholders to understand and communicate risks associated with different ENPs, including their environmental interactions and toxicity.

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**NBR: 247768** **ACRONYM: S3** **EC FUND: 1548529**

**DG:** RTD **Call: FP7-NMP-2009-EU-Russia** **Thema:** NMP-2009-1.2-3

**Title:** Surface ionization and novel concepts in nano-MOX gas sensors with increased Selectivity, Sensitivity and Stability for detection of low concentrations of toxic and explosive agents.

**Abstract:** The objective of S3 is developing breakthrough technologies in gas sensing that will provide higher sensitivity and selectivity at reduced cost. This objective will be pursued by bringing together excellence and complementary skills of ropean Union and Russian groups. Enhanced sensitivity and selectivity will enable toxic and explosive gases to be detected against a background of air constituents and ubiquitous air contaminants. This task will be pursued by studying sensors and sensing principles based on semiconductor nanowires (NWs) molecularly engineered, in terms of doping level, the used additives and /or functionalization processes and heterostructures and deposited onto SiO2/Si and/or alumina MEMS heater platforms. These platforms will be configured in innovative ways to obtain multiple signals from one and the same sensitive layer. Signals

recovered will include resistive, field-effect, ion emission and catalytic/thermal conductivity response of the NW materials. Low power operation and additional enhancements in selectivity will be obtained through pulsed-temperature operation and combined self-heated operation mode using dynamic and steady state responses and modulated optical excitation. Furthermore, the increased stability of NW-based sensing materials will positively affect the reliability of the developed sensors. In order to meet application demands, S3 will further explore novel concepts of sampling, filtering and preconcentration of target substances based on nanostructured filter and enrichment materials. The development and the modelling of this new generation of nanostructured gas-sensing and ion emitting materials will be supported by a wide range of morphological and physico-chemical characterisation techniques. The cooperation between EU Union and Russian groups will be improved and strengthened by short and long term exchanges of researchers, the organization of common workshops and tutorials and the establishment of joint doctoral degrees

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**NBR: 247794** **ACRONYM: NANEX** **EC FUND: 951876**

**DG:** RTD **Call: FP7-NMP-2009-CSA-3** **Thema:** NMP-2009-1.3-2

**Title:** Development of Exposure Scenarios for Manufactured Nanomaterials

**Abstract:** Nanotechnology is a fast growing industry producing a wide variety of manufactured nanomaterials (MNMs) and numerous potential applications. Consequently, the potential for exposure to humans and the environment is likely to increase. Human exposure to MNMs and environmental release of these materials can occur during all the life cycle stages of these materials. For each stage of the life cycle of an MNM, exposure scenarios will need to be developed that effectively describe how exposure to humans and the environment occur and what measures are required to control the exposure. The aim of the NANEX project is to develop a catalogue of generic and specific (ocupational, consumer and environmental release) exposure scenarios for MNMs taking account of the entire lifecycle of these materials. NANEX will collect and review available exposure information, focussing on three very relevant MNMs: (1) high aspect ratio nanomaterials - HARNs) (e.g. carbon nanotubes); (2) mass-produced nanomaterials (e.g. ZnO, TiO2, carbon black); and (3) specialised nanomaterials that are currently only produced on a small scale (e.g Ag)). The exposure information will include both quantitative (measurement results) and qualitative contextual exposure information (risk management measures). We will also review the applicability of existing models for occupational and consumer exposure assessment and for environmental release from these scenarios. We will carry out a small number of specific case illustrations and carry out a gap analyses of the available knowledge and data. Finally, we project knowledge will be disseminated to relevant stakeholders, taking into account other relevant activities that are taking place in this field.

**NBR: 247810** **ACRONYM: NANOHOUSE** **EC FUND: 2400100**

**DG:** RTD **Call: FP7-NMP-ENV-2009** **Thema:** NMP-2009-1.3-1

**Title:** Life Cycle of Nanoparticle-based Products used in House Coating

**Abstract:** NanoHOUSE intends to create a holistic and prospective view on the Environmental Health and Safety (EHS) impacts of nanoproducts used in house building, namely paints and coatings. The latter are using relatively high amounts of Engineered NanoParticles (ENPs) such as nano-Ag and nano-TiO2 which will be investigated. A new Life Cycle Thinking (LCT) approach will be developed gathering two complementary aspects: Investigation of risks and opportunities during the product life cycle as well as Life Cycle Analysis (ISO 14040). LCT will collect information on EHS impacts throughout all life cycle stages of the nanoproducts, identifying the data gaps which will guide the research work. NanoHOUSE will generate reliable scientific information for the missing data and will develop appropriate methods to analyze the potential EHS impacts of nanoproducts. NanoHOUSE first task will be to quantify the actual sources of ENPs during the use and ageing of actual coatings (weathering, renovation, demolition and final disposal). The project will then characterize the environmental compartments significantly impacted by ENPs released from nanoproducts, measure ENPs concentrations and states in those compartments, and investigate their fate in order to increase the knowledge regarding exposure to ENPs with a view to reducing the risks. NanoHOUSE will study the environmental behaviour and the toxicological effects of actually released ENPs ("aged" ENPs) and compare them with pristine ENPs. Finally, NanoHOUSE will improve the solutions for end of life treatments regarding ENPs release in the environment. Main outcomes of the project will be a scientific risk evaluation of nanoproducts used in building, solutions to improve their competitive and sustainable development by decreasing their potential to release ENPs, and contributions to standard tests for their certification. The NanoHOUSE consortium involves 5 research/academic partners and 4 industrial manufacturers of which 1 SME.

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**NBR: 247820** **ACRONYM: NMP-MANUFUTURE** **EC FUND: 800000**

**DG:** RTD **Call: FP7-NMP-2009-CSA-3** **Thema:** NMP-2009-4.0-6

**Title:** EUROPEAN INDUSTRIAL BREAKTHROUGH LEADING TOWARDS AN INTEGRATED COMPETITIVE SUSTAINABLE INDUSTRY

**Abstract:** The project focuses essentially on integration, aiming at bringing together stakeholders and visions in different dimensions among the NMP communities and the NMP and

Manufuture research communities and industrial communities. It will materialise through the organisation of an NMP-Manufuture Conference in Belgium. It will address three major objectives: the interaction, complementarities and synergies between the 'sub-themes' of the NMP theme in FP7, between the NMP and Manufuture communities and the 'research for integrated industrial implementation' through the Manufuture Technology Platform and the related FoF under the EU Recovery Plan. The conference will feature a common policy: oriented plenary session for both objectives, information day sessions integrating the NMP and FoF initiatives. It will also organize brokerage events for project participants and invite potential applicants, and more particularly SMEs. An 'integrated Research and Industries' exhibition is also planned. The conference would gather an international forum to evaluate to what extent integration among the NMP components has been effectively realized and how this could further be materialised and amplified. It would present the preliminary results of the FP6 and FP7 projects, involve the related European Technology Platforms, and the three PPPs or the Recovery Plan, as well as the perspectives of the NMP programme to the scientific public and decision makers. It will promote integration through the Manufuture Technology Platform acting as the integrator of the enabling technologies in the FoF and acting as enabler of the production of the micro and nanotechnology-based products and products composed of new materials. The event would be most timely since it will coincide with the mid-term of the 7th FP, the closure dates of the NMP 2011 Calls for proposals, the recent appointment of the EU Commissioner for Science and Research and the Belgian Presidency.

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**NBR: 247821** **ACRONYM: SAWHOT** **EC FUND: 1550000**

**DG:** RTD **Call: FP7-NMP-2009-EU-Russia** **Thema:** NMP-2009-1.2-3

**Title:** Surface Acoustic Wave wireless sensors for High Operating Temperature environments

**Abstract:** Surface Acoustic Wave (SAW) technology has been applied for more than 20 years to develop sensors exhibiting unique capabilities with limited ageing effects resulting in long term stability properties. During the 90s, they have proved their capability to be wirelessly operated without any on-board power supply. In parallel, the long term development of advanced material, particularly in Russia, has yielded a new class of material, namely Langasite and its variant forms, that can be substituted to quartz and lithium niobate particularly when operating at high temperature. Our project will demonstrate wireless SAW sensors operating in an unprecedented temperature range. This sets extreme challenges to all parts of the sensor system since the developed wireless system will be suitable to operate in harsh environments. The great progress brought by the project takes advantage of a consortium involving complementary major academics and industrial actors of SAW-sensor-based systems capable to successfully face the challenges of implementing a whole system allowing for physical metrology in harsh conditions. Substantial improvements will be provided for sensing physical

parameters in a wide temperature range (-20°C to +650°C), in monitoring a nano-based production process and other applications. Significant knowledge will be generated in nano-sciences and nano-technologies linked to SAW physical sensors and materials for industrial applications. Demonstration of the system will be achieved at an industrial level for monitoring physical parameters under high pressures and high temperatures. The SAWHOT project consortium is set up on the basis of a bilateral Russian-European partnership generating a unique workforce cooperating within the FP7 framework to address this challenge. Finally, this project will bring on sustainable high-tech socio economic prospects : new markets and standards, improved cooperation between EU and Russian organizations.

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**NBR: 247825** **ACRONYM: QUANTUMDOTIMPRINT** **EC FUND: 45000**

**DG:** REA **Call: FP7-PEOPLE-2009-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Quantum dots having molecularly imprinted nanoshell for recognition of antibiotics

**Abstract:** Molecular imprinting of polymers (MIP) is a method to obtain highly functionalised polymers containing binding sites that are able to selectively recognize analyte molecules. In general, this method is based on co-polymerisation of functional monomers around the analyte. Consequently, a cavity formed in the polymer is complementary to the analyte not only in size and shape, but also by the electron density distribution. Thus the MIP is capable of selectively detecting the analyte in surrounding environment. Surface functionalised quantum dots can be applied in a variety of biological investigations, in which traditionally used fluorescent organic molecules fail due to lack of long-term stability and simultaneous detection of multiple signals. The ability to make QDs water soluble and target them towards specific biomolecules either by surface functionalisation or polymeric shell implementation leads to their promising applications in cellular labelling, deep-tissue imaging, immunoassay as well as efficient fluorescence resonance energy transfer donors or acceptors. The main objective of the project is the preparation of quantum dots having biocompatible MIP shell capable of selectively recognizing antibiotics. By combining high selectivity of the MIP and sensitivity of QDs with application of this hybrid material to medical research the project exhibits high inter- and multidisciplinary level as significantly relevant for nowadays sciences. The nanosensors will be characterized in terms of their long-term stability, sensitivity, selectivity, response time, and will subsequently be evaluated for analyte monitoring in biotechnology and medical research. The investigations on the new sensor materials will allow for the study of recognition reactions at the nanometer scale and foster the development of highly defined self-organizing nanostructures.

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**NBR: 247899** **ACRONYM: NANOPOLYTOX** **EC FUND: 2433555**

**DG:** RTD **Call: FP7-NMP-ENV-2009** **Thema:** NMP-2009-1.3-1

**Title:** Toxicological impact of nanomaterials derived from processing, weathering and recycling of polymer nanocomposites used in various industrial applications

**Abstract:** The project NANOPOLYTOX will evaluate the toxicological impact of nanomaterials included in polymer nanocomposites, highly used in various industrial sectors, during their life cycle. The toxicological profile will be correlated with the changes in the physical and chemical properties of the nanomaterials during the artificial aging/weathering process of the polymeric nanocomposites. Raw nanomaterials and extracted nanomaterials will be characterized at different stages of their life cycle and their toxicity profiles will be obtained via in vitro and in vivo toxicity studies. The results from the in vivo studies will be used for the evaluation of the biological and environmental fate of nanomaterials. All the data generated during the project (physical, chemical and toxicological data) will be considered for the development of the novel LCIA methodology to apply to nanomaterials. These studies will also be taken into account for the selection of adequate digestion and extraction methods to separate the nanomaterials from the polymeric matrices. Moreover, optimization of these methods will facilitate the development of recycling techniques that will be applied in the end-stage of polymer nanocomposites. Disposal of the extracted toxic and/or innocuous nanomaterials will be carried out by mechanical and chemical recycling techniques. The chemical recycling technique will be based on a new separation method consisting of nanofiber filters to separate efficiently the raw nanomaterials from the polymeric matrices and re-use them in new applications. Finally, the nanofiber filters containing toxic nanomaterials will be immobilized in xerogel matrices by sol-gel processes and sintering.

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**NBR: 247928** **ACRONYM: LAMP** **EC FUND: 2300000**

**DG:** CNECT **Call: FP7-ICT-2009-4** **Thema:** ICT-2009.3.8

**Title:** LASER INDUCED SYNTHESIS OF POLYMERIC NANOCOMPOSITE MATERIALS AND DEVELOPMENT OF MICRO-PATTERNED HYBRID LIGHT EMITTING DIODES (LED) AND TRANSISTORS (LET)

**Abstract:** The project described in this proposal aims at developing a new methodology to obtain semiconductor quantum dots (QDs) regioselectively in a polymeric matrix by means of a heating probe (laser). This new method is designed to produce light emitting devices (LED/T) based on semiconductor/polymer nanocomposite emission without using lithographic processes. This type of effect is possible because, after being heated, certain types of molecules produce metal or semiconductor QDs. If this process is carried out in polymeric foil, the resulting nanocomposite can be used for several

purposes. It may be particularly appealing for industrial applications since it results in conducting/semiconducting micro/nano-regions in predetermined areas of the polymer without any patterning process. The potential applications of this technology can be utilized in many fields such as memory data storage, labelling of goods and, as proposed in this project, for the construction of displays. Producing a LED/T with this methodology requires selecting several types of polymers, metal-thiolate precursors (both metal and thiol group), lasers and LED/T architectures. To simplify the concept, the whole process sequence involves material synthesis as the first step, then the formation of the polymer/precursor foil, its laser irradiation in specific regions so that only the irradiated region will be enriched with QD, and, finally, testing the LED/T. Combining the electro-optical properties of QDs, the ease of processing of polymers and the use of laser will allow for the construction of a light-emitting device (LED/T) with increased life-time as well as obtaining matrices of LED/Ts (pixels) without any patterning or inkjet processing. The expected results of this project are: i) understanding the mechanism of the nanocomposites formation "in situ" and its optimization and ii) the formation of LED/T with enhanced electro-optical properties (QDs) without the use of any patterning process.

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**NBR: 247967** **ACRONYM: NANOCOM** **EC FUND: 1800000**

**DG:** RTD **Call: FP7-NMP-2009-CSA-3** **Thema:** NMP-2009-1.2-5

**Title:** Lowering Barriers for Nanotechnology Commercialisation via Open Innovation

**Abstract:** The NanoCom coordinated action will contribute to bridging the gap between lab based and industrial applications in nanotechnology by creating a European wide approach and mechanisms for lowering the barriers and spreading best open innovation practices for rapid commercialisation and investment in innovative nanotechnology driven products. The vision will be supported by the following key objectives: • To carry out a critical analysis of barriers for rapid commercialisation of emerging Micro and Nano Technologies (MNT) that result from many complementary EC, national and industrially funded Research and Development (R&D) projects • To analyse and promote best practices via new nanotechnology and nano-manufacturing specific open innovation methodology and tools and provide roadmapping, policy and investment advise at EU, national and regional levels • To create a commercialisation oriented forum and mechanisms for coordinating the efforts of many complementary R&D projects in ERA • To provide support for training and dissemination of best practices for open innovation and commercialisation of nanotechnology. The NanoCom outcomes will target the creation of new Open Innovation approach and support environment for overcoming the barriers to commercialisation of nanotechnology results in Europe and promoting and spreading best practices. The results of the project will dramatically increase the uptake of nanotechnologies and facilitate the development of a strong and thriving European nano-manufacturing sector providing global innovation leadership in the field.

**NBR: 247978** **ACRONYM: POLARIC** **EC FUND: 9859375**

**DG:** CNECT **Call: FP7-ICT-2009-4** **Thema:** ICT-2009.3.3

**Title:** Printable, organic and large-area realisation of integrated circuits

**Abstract:** The objective of the project is to realise high-performance organic electronic devices and circuits using large-area processing compatible fabrication methods. The high performance of the organic circuits referred to here means high speed (kHz-MHz range), low parasitic capacitance, low operating voltage, and low power consumption. The related organic thin film transistor (OTFT) fabrication development will be focused to enable a high resolution nanoimprinting lithography (NIL) step, which is compatible with roll-to-roll processing environment. Applying NIL will enable smaller transistor channel lengths (down below 1 µm) and thereby an increase in the speed of the device. Another important concept to improve the performance is the self-aligned fabrication principle, in which the critical patterns of the different OTFT layers are automatically aligned in respect to each other during the fabrication. This decreases the parasitic capacitances and thereby increases the speed of the device, and is one of the key elements to enable the use of large-area fabrication techniques such as printing. Also complementary transistor technology will be developed, which will enable a decrease in operating voltage and power consumption. The high performance organic transistors will be tested in basic electronic building blocks such as inverters and ring oscillators. The technology development will be exploited in the active matrix liquid crystal display (AMLCD) and radio-frequency identification (RFID) demonstrators. In addition to showing that sufficient performance can be reached without sacrificing the mass fabrication approach, solutions for the fabrication of roll-to-roll tools in order to make serial replication viable will be provided. Finally, the design, characterization, and modeling of submicron low-power OTFTs will be done in order to support the fabrication of the demonstrators based on the technology developed in the project.

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**NBR: 247989** **ACRONYM: NANOSUSTAIN** **EC FUND: 2475054**

**DG:** RTD **Call: FP7-NMP-ENV-2009** **Thema:** NMP-2009-1.3-1

**Title:** Development of sustainable solutions for nanotechnology-based products based on hazard characterization and LCA

**Abstract:** Objective of the NanoSustain project is to develop innovative solutions for the sustainable design, use, recycling and final treatment of nanotechnology-based products This will be achieved by a comprehensive data gathering and generation of relevant

missing data, as well as their evaluation and validation, for specific nanoproducts or product groups in relation to their human health and environmental hazards and possible impacts that may occur during after-production stages. Although production of nanomaterials is rapidly increasing, our knowledge about possible health and environmental effects associated with these materials is still rather poor. This lack of knowledge calls for more research. Due to their small size, nanoparticles behave different than their chemical analogues. They can be taken up easily and in a unique way with possible adverse effects in man and organisms. Assessing their hazard is complex and needs new approaches and a close international cooperation. NanoSustain will address the questions, (1) how and to what degree society and the environment will be exposed to nanomaterials and associated products, and (2) where do these particles end up? Expected results will improve our present knowledge on the impact and fate of these particles after entering economic and natural cycles. NanoSustain has mobilized the critical mass of expertise, resources and skills to tackle this complex issue. Based on results from hazard characterization, impact assessment and LCA, we will explore on a lab-scale new solutions for the design of selected nanomaterials and associated products and their sustainable use, recycling and final treatment. As the concerned nanotech industry will actively participate in the planned project, NanoSustain will set the ground for the development of new sustainable products and industrial applications, and hence help to strengthen competitiveness of the European nanotechnology industry.

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**NBR: 247991** **ACRONYM: PLAISIR** **EC FUND: 2850000**

**DG:** CNECT **Call: FP7-ICT-2009-4** **Thema:** ICT-2009.3.8

**Title:** PLAsmonic Innovative Sensing in the IR

**Abstract:** The aim of this project is to transfer the latest advances in plasmonics achieved in the visible to the mid-IR. The main objectives of the project are (1) to look at the fundamental limits and develop new simulation tools for plasmons in the mid-IR, (2) to develop plasmon enhanced surfaces for spectroscopic chemical sensing (SCS), and (3) to use plasmon enhanced surfaces for light harvesting technology. The result of the project will include new software, SCS surfaces for infra-red spectroscopy and smart, cheaper, mid-IR photodetectors. The term plasmonics refers to the investigation, development and application of enhanced electromagnetic properties of metallic (nano-) structures and is starting to find applications in a range of photonic devices such as VCSELs and high speed photodetectors. While the promise of plasmonics photonic components in the visible and NIR is very promising, this project will exploit the huge potential for plasmonics in the IR (i.e. the 1.6-16 µm range) that could be truly disruptive. In the mid-IR (a) plasmon losses are much lower than in the visible so the range of possible devices is much larger (b) this area is largely unexplored for applied plasmonics, and (c) IR technology is undergoing a quiet revolution due to key advances such as such room

temperature Quantum Cascade Lasers and miniature Fourier transform spectrometers (FTS). This project will help launch the IR revolution by enabling both SCS surfaces and better mid-IR detectors. PLAISIR will develop SCS with sensitivity more than 200 times larger than that of a simple surface. This will be combined with microfluidics and integrated into a FTS. The project will work with both InGaAs and HgCdTe photodetectors, by using LHT to improve their noise performance, and tailor their spectral and polarization response. This project includes 4 major actors in fundamental and applied plasmon research, 3 SMEs and an external advisory board made up of strategic end users and key academics

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**NBR: 248154** **ACRONYM: PRIMA** **EC FUND: 2300000**

**DG:** CNECT **Call: FP7-ICT-2009-4** **Thema:** ICT-2009.3.8

**Title:** Plasmon Resonance for IMproving the Absorption of solar cells

**Abstract:** The demand for affordable renewable energy is increasing steadily. Electricity generation by photovoltaic cells is one of the main players in this field, but is hampered by its still relatively high cost compared with other sources of energy. Within this project we investigate promising nanotechnology - based strategies to enhance the performance and/or reduce the cost of different solar cell technologies. Specifically we examine the use of metal nanostructures to enhance the optical absorption of light into different types of solar cells, including crystalline Si, high performance III-V, organic and dye-sensitized solar cells. The enhanced absorption can ultimately lead to thinner and therefore less expensive solar cells due to the use of less material. One of the remaining issues in this field, that of better physical insight in the possible plasmonic enhancement mechanisms, will be studied in detail using calculations and experiments on structures with different degrees of complexity. In parallel, we investigate the manufacturability of these nanostructures and the ease of integrating them into existing process flows for solar cells. This will allow us to examine industrially relevant structures, integrate them into solar cells and test their performance. The performance will be bench-marked and assessed by solar cell companies that are participating in the project. European science traditionally is a leader in both the fields of photovoltaics and nanoplasmonics and this project helps to maintain Europe's strong position. Moreover it provides the participating industrial partners with a competitive advantage, which should create employment and sustainable economic growth in Europe, while simultaneously contributing to a reduction of the emission of greenhouse gases.

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**NBR: 248178** **ACRONYM: NANORUCER** **EC FUND: 349000**

**DG:** RTD **Call: FP7-NMP-2009-Mapping** **Thema:** NMP-2009-1.2-4

**Title:** Mapping the NANOtechnology innovation system of RUssia for preparing future Cooperations between the EU and Russia

**Abstract:** The EU is interested in obtaining a survey of main Russian research infrastructures active in nanotechnology and nano-structured materials as a basis for initiating future cooperations between the EU and Russia. In the NANORUCER activity two leading organization from the EU and Russia in the fields of innovation research and nantoechnology join forces to deliver this aim. Based on a performance analysis using bibliometrics and patent statistics and a careful in depth mapping of nanotechnology and nano-strucutured materials research activities in Russia, a strengths and weaknesses analysis of the Russian nanotechnology innovation system will be made. A systematic comparison with respective EU R&D activities in nanotechnology and nano-structured materials will allow identifying opportunities for future cooperations between the EU and Russia. These will be specified by thematic fields in order to detect areas of common interests with most benefits for cooperating partners. Involving Russian and EU stakeholders during workshops, recommendations for supporting such cooperations between the EU and Russia will be developed, and concrete actions proposed. A particular strength of the proposed support action is that it can build on a broad experience of both participants in analysing nanotechnology innovation systems. In previous projects the Russian partner has already developed databases of R&D organizations providing research on nanoscale and its staffs provided the expertise for the National Program of Infrastructure Development for Nanotechnology. In addition the participants will mobilize the in depth knowledge of their mother organizations, the Fraunhofer Society and in particular the Fraunhofer Alliance Nanotechnology, and the Russian Academy of Sciences, in nantotechnology R&D.

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**NBR: 248219** **ACRONYM: PRONANO** **EC FUND: 1099991**

**DG:** RTD **Call: FP7-NMP-2009-CSA-3** **Thema:** NMP-2009-1.2-5

**Title:** Promoting Technology Transfer of Nanosciences, Nanotechnologies, Materials and new Production Technologies

**Abstract:** ProNano aims at validating new practices to remove the major barriers that prevent results out of scientific research projects on nanotechnology field from reaching market applications: market barriers, technology barriers, financial barriers, managerial barriers. Managed by experienced innovation consultant firms and venture capitalist from several European countries, and involving European and national nanotechnology networks and platforms, ProNano promotes existing results of scientific research projects available in EU research centres that have not yet been exploited, through assistance to the entrepreneurial teams connected to such research work. First, existing research results

are identified and screened for evaluation of their commercial potential. The technical information is completed by a business-relevant analysis of technological competitive markets, road maps to financing, and management issues leading to draft business plans. Then, potential entrepreneurs and investors are associated to this process and coached by technology transfer and innovation professionals including specialists in venture capital/ private equity financing and banking instruments. The promising nanotechnologies are made ready to be licensed for sale to industry or developed into business proposals for start-up companies. ProNano ultimately aims at closing investment deals to prove the approach successful (completing full financing rounds to venture capital investors/established businesses, or licensing agreements). Lessons learnt during the project and policy recommendations are presented to the broad public at a final event.

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**NBR: 248236** **ACRONYM: INGENIOUS** **EC FUND: 1539000**

**DG:** RTD **Call: FP7-NMP-2009-EU-Russia** **Thema:** NMP-2009-1.2-3

**Title:** Innovative Nanostructured Optochemical Sensors

**Abstract:** Polycyclic Aromatic Hydrocarbons (PAH's) and VOCs like benzene, toluene and xylenes (BTX) are compounds of great social and environmental significance, are widely used in industry, in many different applications. However, they and can present serious medical, environmental, and explosion dangers. Because they are toxic even at parts per- billion concentrations, it is essential to know their concentration in the air, especially in industrial and populated areas. Measurement of these toxic compounds at trace levels in multi analyte mixtures is still a challenging task however, and involves the use of expensive laboratory bound equipment. This severely limits risk analysis and timely initiation of preventive measures in a working environment. The main objective of the INGENIOUS project is the development, evaluation and validation of novel ultra-sensitive and selective nanostructured optochemical sensors for the detection of PAHs (polycyclic aromatic hydrocarbons) and BTX (benzene, toluene, xylene) from complex mixtures. Within the sensor concept, nanoparticle-based materials with high selectivity and sensitivity will be created by combining principles of molecular imprinting and plasmonic enhancement of molecular fluorescence. Silica and polymer core-shell nanoparticles with molecularly imprinted shells will be used as building blocks of self-assembling colloidal aggregates acting as chemosensing elements. The sensing elements and microarrays of sensing elements will be obtained using modern printing technologies such as ink-jet and microcontact printing. The combined sensor elements will be implemented on a polymer foil format and validated as sensor transducers. The technology will be incorporated into an in-plane optical read-out platform and demonstrated for specific end user applications. The suggested approach will be used to create sensor devices capable of detecting relevant analytes in industrial processes, occupational health and plants safety like PAH

**NBR: 248295** **ACRONYM: OSIRIS** **EC FUND: 818367**

**DG:** CNECT **Call: FP7-ICT-2009-4** **Thema:** ICT-2009.9.3

**Title:** Towards an Open and Sustainable ICT Research Infrastructure Strategy

**Abstract:** The OSIRIS consortium is composed of participants involving Public Authorities and RI Champions across 12 EU Members States and Associated Countries and regions with direct links to existing and future ICT European RIs (i.e. High Performance Computing, Grids, Networks, Micro/Nanoelectronics and Future Internet). OSIRIS therefore has been established with the necessary structure and elements to reach its objectives: The main aim of the OSIRIS project initiative is to provide structured information and models for decision makers (European Commission, Member States, Associated Countries) who develop cross border public-public partnerships and who establish a coordinated approach to future large scale investments in transnational European ICT RIs. The OSIRIS project and consortium will collect, structure and provide this information based on an analysis of the current coordinating organizations active in the field and relevant documents and provide an overview and qualitative model of the important subjects to be considered when setting-up and running an ICT RI including Governance, Policy, Sustainability, Operational principles,.. This qualitative model will be applied to important examples of ICT research infrastructures together with a more detailed analysis of a representative set of ICT research infrastructures The OSIRIS project and consortium therefore paves the way to a platform for continuous analysis and recommendations on existing and future European ICT RIs leading to: • Complementary or common planning of investments and investment policies in order to obtain sustainable European ICT RIs • Procedures, rules and management mechanisms for coordinated investments in large scale transnational ICT RI's in Europe

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**NBR: 248304** **ACRONYM: P3SENS** **EC FUND: 2596909**

**DG:** CNECT **Call: FP7-ICT-2009-4** **Thema:** ICT-2009.3.8

**Title:** Polymer Photonic multiparametric biochemical SENSor for Point of care diagnostics

**Abstract:** The detection of chemical or biological substances increasingly appears as an essential concern in order to prevent human or animal health and security related problems. Present analytical techniques are expensive and often require highly specialized staff and infrastructures. The principal need is to perform screening tests, which can be carried out in non-specialized infrastructures, e.g. Point of Care, schools and field, before unambiguous identification in a specialized laboratory. There is thus a need to

develop a new detection system that has low-cost and is portable but at the same time offers high sensitivity, selectivity and multi-analyte detection from a sample containing various components (e.g. blood, serum, saliva, etc.). The objective of P3SENS is to design, fabricate and validate a multichannel (50 or more) polymer photonic crystal based label-free disposable biosensor allowing for a "positive/negative" detection scheme of ultra small concentrations of analytes in solution (< 1 ng/mL). The biosensor will be encapsulated in a specifically designed microfluidic system in order to deliver the sample to the multiple sensing zones. The design of the biochip will allow it to be easily inserted in a compact measurement platform, usable by non-specialized practitioners outside of specialized laboratories for carrying simultaneous multi-analyte detection, delivering real-time monitoring, and with an assay duration that will not exceed a few tens of minutes. The photonic chip proposed in this project will be based on polymer Photonic Crystal (PhC) micro-cavities coupled into a planar waveguide optical distribution circuit. The photonic chip will be fabricated with available fabrication technologies - and with an emphasis on low cost substrates (polymer) and fabrication processes (nano-imprint lithography). More generally, P3SENS will push forward the development of low cost disposable biochips based on photonics.

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**NBR: 248538** **ACRONYM: SYNAPTIC** **EC FUND: 3520000**

**DG:** CNECT **Call: FP7-ICT-2009-4** **Thema:** ICT-2009.3.2

**Title:** SYNthesis using Advanced Process Technology Integrated in regular Cells, IPs, architectures, and design platforms

**Abstract:** This proposal addresses Objective ICT-2009.3.2: "Design of Semiconductor Components and Electronic Based Miniaturized Systems" by development of "methods and tools to cope with the design challenges in the next generations of technologies" and focuses on the objective "design for manufacturability taking into account increased variability of new processes". The project described in this proposal targets the optimization of manufacturability and the reduction of systematic variations in nanometer technologies through exploitation of regularity at the architectural, structural, and geometrical levels. We propose the creation of a methodology and associated suite of design tools which extract regularity at the architectural and structural level and automate the creation of regular compound cells which implement the functionality of the extracted templates. The cell creation will employ Restricted Design Rules (RDR's) and other regularity techniques at the geometrical level to maximize manufacturability and reduce systematic variations. Since the majority of designs in the nanometer regime employ some form of SRAM the project will include a study of the effects of RDR's on SRAM in terms of performance and manufacturability and the subsequent definition of a set of RDR's which allow manufacturability optimization for logic functions while remaining compatible with SRAM technologies. To this end we have assembled a consortium of European academic, research and industrial experts with world class experience in

regularity approaches at the various levels. In order to ensure the successful commercialization and deployment of the resulting tool suite the consortium includes a European EDA vendor with significant expertise in the field of design optimization through automated cell creation. This project will enable European industry to play a leading role in the definition of next generation design methodologies and challenge the US domination in the area of design automation.

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**NBR: 248613** **ACRONYM: DIAMOND** **EC FUND: 2893000**

**DG:** CNECT **Call: FP7-ICT-2009-4** **Thema:** ICT-2009.3.2

**Title:** Diagnosis, Error Modelling and Correction for Reliable Systems Design

**Abstract:** Increasing design costs are the main challenge facing the semiconductor community. Assuring the correctness of the design contributes to the major part of the problem. However, while diagnosis and correction of errors are more time-consuming compared to error detection, they have received far less attention, both, in terms of research works and industrial tools introduced. Another, orthogonal threat to the development is the rapidly growing rate of soft-errors in the emerging nanometer technologies. According to roadmaps, soft-errors in sequential logic are becoming a more severe issue than in memories. However, the design community is not ready for this challenge because existing soft-error escape identification methods for sequential logic are inadequate. The DIAMOND project addresses the above-mentioned challenges. The aim of DIAMOND is improving the productivity and reliability of semiconductor and electronic system design in Europe by providing a systematic methodology and an integrated environment for the diagnosis and correction of errors. DIAMOND will develop: - A unified, holistic diagnostic model for design and soft errors; - Automated localisation and correction techniques based on the unified model, both pre-silicon and post-silicon; - Implementation of a reasoning framework for localisation and correction, encompassing word-level techniques, formal, semi-formal, and dynamic techniques; - Integration of automated correction with the diagnosis methods. DIAMOND reaches beyond the state-of-the-art by proposing an integrated approach to localisation and correction of specification, implementation, and soft errors. In addition, it considers faults on all abstraction levels, from specification through implementation down to the silicon layout. Handling this full chain of levels allows DIAMOND take advantage of hierarchical diagnosis and correction capabilities incorporating a wide range of error sources.

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**NBR: 248629** **ACRONYM: SOLID** **EC FUND: 5412000**

**DG:** CNECT **Call: FP7-ICT-2009-4** **Thema:** ICT-2009.8.2

**Title:** Solid State Systems for Quantum Information Processing

**Abstract:** The SOLID concept is to develop small solid-state hybrid systems capable of performing elementary processing and communication of quantum information. This involves design, fabrication and investigation of combinations of qubits, oscillators, cavities, and transmission lines, creating hybrid devices interfacing different types of qubits for quantum data storage, qubit interconversion, and communication. The SOLID main idea is to implement small solid-state pure and hybrid QIP systems on common platforms based on fixed or tunable microwave cavities and optical nanophotonic cavities. Various types of solid-state qubits will be connected to these "hubs": Josephson junction circuits, quantum dots and NV centres in diamond. The approach can immediately be extended to connecting different types of solid-state qubits in hybrid devices, opening up new avenues for processing, storage and communication. The SOLID objectives are to design, fabricate, characterise, combine, and operate solid-state quantum-coherent registers with 3-8 qubits. Major SOLID challenges involve: Scalability of quantum registers; Implementation and scalability of hybrid devices; Design and implementation of quantum interfaces; Control of quantum states; High-fidelity readout of quantum information; Implementation of algorithms and protocols. The SOLID software goal is to achieve maximal use of the available hardware for universal gate operation, control of multi-qubit entanglement, benchmark algorithms and protocols, implementation of teleportation and elementary error correction, and testing of elementary control via quantum feedback. An important SOLID goal is also to create opportunities for application-oriented research through the increased reliability, scalability and interconnection of components. The SOLID applied objectives are to develop the solid-state core-technologies: Microwave engineering; Photonics; Materials science; Control of the dynamics of small, entangled quantum systems

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**NBR: 248789** **ACRONYM: TRAMS** **EC FUND: 2449974**

**DG:** CNECT **Call: FP7-ICT-2009-4** **Thema:** ICT-2009.8.1

**Title:** TERASCALE RELIABLE ADAPTIVE MEMORY SYSTEMS

**Abstract:** Technology projections indicate that future electronic devices will keep shrinking, being faster and consuming less energy per operation. In the next decade, a single chip will be able to perform trillions of operations per second and provide trillions of bytes per second in off-chip bandwidth. This is the so called Terascale Computing era, where terascale performance will be mainstream, available in personal computer, and being the building block of large data centers with petascale computing capabilities. However, these smaller devices will be much more susceptible to faults and its performance will exhibit a significant degree of variability. As a consequence, to unleash these impressive

computing capabilities, a major hurdle in terms of reliability has to be overcome. The TRAMS project is the bridge for reliable, energy efficient and cost effective computing in the era of nanoscale challenges and teraflop opportunities. The International Roadmap for Semiconductors (ITRS) report indicates that the Metal Oxide Semiconductor devices (MOS or MOS like devices) will be ultimately scaled down below 10 nm in several years. The CMOS technologies after the 16 nm technology generation are called Late CMOS technologies and will include novel multigate device architectures and novel channel and gate stack materials. Reliability issues are expected to be exacerbated to in sub-10 nm CMOS technology. Beyond-CMOS emerging technologies will reach device dimensions reduction below 5 nm utilising among others, nanowire transistors, quantum devices, carbon nanotubes, graphene, or molecular electronics. Both the Late CMOS and the Beyond CMOS technologies hold the promise of a significant increase in device integration density complemented by an increase in system performance and functionality. However, a dramatic reduction in single device quality is also expected, complemented by increase in statistical variability, severe reduction of the signal to noise ratio, and severe reliability problems. Therefore,alternative device solutions and computation paradigms need to be investigated to keep the technology evolution pace in such a challenging scenario. Memory cells and, in general, system architectures intended for nanotechnologies (both late CMOS and emerging devices) need to address the variability and reliability problem and should be capable of solving or at least largely alleviating it. In order to build reliable nanosystems, the TRAMS project addresses a specific variability and reliability-aware analysis and design flow as well as a hierarchical tolerance design. In such a tera-device multicore system the main idea will be to define countermeasure techniques at circuit and architecture design levels. The objective of this project is to investigate in depth potential new design alternatives and paradigms, which will be able to provide reliable memory systems out of highly unreliable nanodevices at a reasonable cost and design effort.

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**NBR: 248819** **ACRONYM: MUCOSINT** **EC FUND: 75000**

**DG:** REA **Call: FP7-PEOPLE-2009-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Multifunctional Composite Silica Nanotubes for Targeted Delivery

**Abstract:** Multifunctional nanoparticles hold great promise in targeted therapy as well as other biotechnological fields such as biomolecule sensing and cell separation. The potential of these particles to controllably deliver and accumulate therapeutic and diagnostic agents to target sites in the body make them especially useful platforms for the research in various disease types. Ideal particles for these applications should be easy to synthesize, have minimal size variation and hold efficient functionalities. Combining all these properties in the nanoscale level, however, is a formidable challenge. This project proposes a new class of non-spherical nanoparticles called Multifunctional Composite Silica Nanotubes (MuCoSiNT) for targeted therapeutic delivery applications. MuCoSiNTs

will be fabricated by a facile synthesis method that allows absolute control over particle dimensions and functionalities. Moreover, they comprise large inner voids that will be filled with a composite gel matrix for the targeted delivery of imaging and therapeutic agents at high payload capacities. The in vitro cytotoxicities and antitumor activities of these particles will be determined by examining their effect on cellular viabilities and growth inhibition profiles. Finally, MuCoSiNT internalization into the cells and consequent morphological changes will be confirmed using microscopic techniques.

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**NBR: 248835** **ACRONYM: SPEDOC** **EC FUND: 1900000**

**DG:** CNECT **Call: FP7-ICT-2009-4** **Thema:** ICT-2009.3.8

**Title:** Surface Plasmon early Detection and Treatment Follow -up of Circulating Heat Shock Proteins and Tumor Cells

**Abstract:** Cancer causes an increased expression of Heat Shock Protein HSP70 in the peripheral blood, at the surface of, and in cancer cells as a result of different sources of stress, including anti-cancer treatments. It was recently demonstrated that tumorigenicity, metastatic potential and resistance to chemotherapy correlated with an increased of expressed HSP70 in cancer cells. On the contrary, HSP70 depletion using combinatorial small peptides called peptide aptamers sensitizes cancer cells to die and could help in cancer therapy. The core goal of this project is to combine the latest advances of nano-optics, optical manipulation and microfluidics with the ultimate understanding of HSP70 to develop a novel integrated and ultra sensitive sensing platform for early cancer detection. An early detection would benefit to traditional but also new cancer therapies based on peptide aptamers which could be delivered sooner and at lower doses. The planned sensing device, based on surface plasmon resonances supported by micro and nano-structures, will operate in a microfluidic circuit to minimize the volumes of analytes and increase reproducibility. Enhanced and confined plasmonic fields will be engineered at the nanoscale to implement two main sensing schemes: (i) ultra sensitive tracking of HSP70 proteins circulating in the peripheral blood based on resonance shift induced by specific protein/receptor binding, (ii) individual cell optical trapping (exploiting latest generation of plasmonics tweezers) combined with scattering imaging and Surface Enhanced Raman Scattering to monitor the concentration of HSP70 proteins at the membrane surface and achieve systematic cancer cell screening. These transduction mechanisms and plasmonic tweezers will be integrated into a compact platform to operate in a biological laboratory environment. Such a portable device should be seen as a precursor of a future device enabling point of care diagnostics in a medical environment and leading to individualized therapy.

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**NBR: 248855** **ACRONYM: NANOPHOTONICS4ENERGY** **EC FUND: 2900000**

**DG:** CNECT **Call: FP7-ICT-2009-4** **Thema:** ICT-2009.3.8

**Title:** Nanophotonics for Energy Efficiency

**Abstract:** The Nanophotonics for Energy Efficiency proposal aims to create a virtual centre of excellence to re-orient and focus nanophotonics research towards the challenges in energy efficient applications. The network will cluster nanophotonic laboratories and research groups in Europe combining their expertise in the development of disruptive approaches to lighting and solar cell technology. The consortium consolidates know-how and resources of 9 different institutions in 6 European countries with complimentary research and development expertise, integrating more than 130 scientists, engineers, technicians and managers in nanophotonics. The project pursues a scientific bottom-up approach to ensure that novel ideas and scientific breakthroughs as well as established proof-of-concepts in academia are promoted along the value chain towards reaching their eventual goal of commercialization. Market and industrial relevance is ensured through the involvement of industry leaders in the Advisory Board. This approach complements the existing top-down, industry-driven projects like e.g. OLED100.eu. The project intends to achieve the overall long-term integration goal by coordinating three main efforts: 1. Realising a strategy for successful integration: creation of new research clusters and a virtual laboratory network that will lead to the creation of a lasting entity that will exist beyond the duration of this NoE 2. Establishing joint research: foster collaborations among the leading groups in nanophotonics for energy efficiency, interchanging knowledge and best practices, and paving the way towards the establishment of common research agendas 3. Spreading knowledge: education and training specially geared towards young researchers and technicians – both on S&T issues as well as on complementary skills like communication, business, entrepreneurial or IPR skills – and dissemination towards the scientific community, industry, and the public in general

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**NBR: 248909** **ACRONYM: LIMA** **EC FUND: 2375000**

**DG:** CNECT **Call: FP7-ICT-2009-4** **Thema:** ICT-2009.3.8

**Title:** Improve Photovoltaic efficiency by applying novel effects at the limits of light to matter interaction

**Abstract:** The LIMA project exploits cutting edge photonic technologies to enhance silicon solar cell efficiencies with new concepts in nanostructured materials. It proposes nano-structured surface layers designed to increase light absorption in the solar cell while decreasing surface and interface recombination loss. Integration in a back contact design further reduces these interface losses and avoids shading. The project improves light-matter interaction by the use a surface plasmonic nanoparticle layer. This reduces

reflection and efficiently couples incident radiation into the solar cell where it is trapped by internal reflection. Surface and interface recombination are minimised by using silicon quantum dot superlattices in a passivating matrix. The distance between quantum dots ensures wave-function overlap and good conductivity. An effective field at the superlattice - crystalline silicon interface ensures that the cell is insensitive to the recombination velocity at this heterojunction, and further increases the collection probability in the quantum dot layer. The dots allow a fundamental efficiency enhancement due to experimentally confirmed multiple exciton generation. This mechanism increases photocurrent and can in theory raise the theoretical single junction efficiency limit from 33% to 44%. These surface plasmonic and quantum dot layers are integrated in a high efficiency crystalline silicon back contact cell. This is designed such that the space charge region is separated from the superlattice – crystalline silicon heterojunction minimising non radiative space-charge recombination. The back contacts and dielectric electrical insulator are designed to maximise back surface reflection and enhance the light trapping of incident radiation without shading losses. The project combines expertise between academic and industrial partners. The goal is a high efficiency cell using novel concepts to enhance proven cell designs.

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**NBR: 248972** **ACRONYM: NANOC** **EC FUND: 2925000**

**DG:** CNECT **Call: FP7-ICT-2009-4** **Thema:** ICT-2009.3.2

**Title:** Nanoscale Silicon-Aware Network-on-Chip Design Platform

**Abstract:** The NaNoC project aims at developing an innovative design platform for future Network-on-Chip (NoC) based multi-core systems. This NaNoC design platform intends to master the design complexity of advanced microelectronic systems by enabling strict component oriented architectural design. A compositional approach to NoC design in future multi-core chips is out of the reach of current design methods and tools due to new design constraints. Requirements for co-design with high-level platform management frameworks facilitates a need for enhanced dynamism and flexibility in NoC composition (e.g., virtualization, power management, thermal management, application management). On the other hand, a higher degree of uncertainty originating from nanoscale IC fabrication technologies raises the need to build reliable systems out of unreliable components. The NaNoC design platform provides design methods and prototype tools to cope with both challenges and to make NoCs a mainstream interconnect backbone for effective system integration. The platform enables NoC component assembly at each layer of the design hierarchy. Therefore, design for manufacturability techniques and tools are developed to preserve yield in the presence of manufacturing defects and circuit performance/power variability. Above all, the NaNoC design platform fosters the tight cooperation between system research, circuit design and process development by means of a silicon-aware decision making at each layer of the design hierarchy. In this direction, NaNoC not only provides a cross-layer

approach to tackle composability challenges (e.g., physical design techniques for enhanced reliability combined with architecture-level techniques for fault containment), but also defines an exchange format for interoperability between design tools for cross-layer optimization. Interoperability between developed NoC design methods/prototype tools and mainstream design toolflows will also be pursued.

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**NBR: 249032** **ACRONYM: MATCHIT** **EC FUND: 2770000**

**DG:** CNECT **Call: FP7-ICT-2009-4** **Thema:** ICT-2009.8.3

**Title:** Matrix for Chemical IT

**Abstract:** MATCHIT (MATrix for CHemical IT) will develop programmable information chemistry by introducing an addressable chemical container (chemtainer) production system and interfacing it with electronic computers via MEMS technology with regulatory feedback loops. As in the biological subcellular matrix, the chemical containers at the micro- and nanoscales will be self-assembling, replicable and self-repairing. At the nanoscale, DNA containers will provide a programmable and replicable chemistry in which positional information can be harnessed for a range of nanoscale utilities. At the microscale, containers based on DNA-labeled heterophase droplets and vesicles, will form microscopic labeled reaction vessels that can themselves determine their next processing steps. Their DNA-based addresses will be computable, enabling parallel chemical programming in a new multilevel architecture through autonomous address modification and resolution at the container-container, container-surface, and container-molecule levels, providing a concrete embedded application for DNA computing. This generic programmable information chemistry will not only be an enabling technology for “immersed systems” IT applications in the life sciences, chemistry, and nanotechnology, but also promote a deeper understanding of the computational power of coupled production and information processes, as in biology, and provide a platform for building the more organic computers of the future. MATCHIT will investigate the general use of self-assembling chemtainers for information-intensive Chem-IT. The project will develop and apply multiscale physical simulation tools and novel embedded IT architectures to process and integrate modular chemical and digital information. It will integrate and disseminate multidisciplinary European activities in Chem-IT, supported by the European Center for Living Technology and provide an assessment of the likely long-term socio-technical impact of this powerful technology.

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**NBR: 249135** **ACRONYM: PLATON** **EC FUND: 2599816**

**DG:** CNECT **Call: FP7-ICT-2009-4** **Thema:** ICT-2009.3.8

**Title:** Merging Plasmonic and Silicon Photonics Technology towards Tb/s routing in optical interconnects"

**Abstract:** PLATON aims to realize a fully integrated Tb/s optical routing system for data networks expecting to deliver important advantages to the end-users as it will enable high-speed communications and ultra-fast access to data information being stored at large computer centers whilst investing in a new technological platform of lower cost, lower power consumption and reduced size requirements. This will allow for the effective consolidation of today's Internet and computer server rooms storing huge amounts of information into smaller-size rack- or even box-interconnect environments. PLATON's routing fabric will employ novel plasmonic switching elements on a silicon motherboard and will develop novel fabrication processes for enabling the merger of plasmonics with silicon nanophotonics and electronics, targeting the combined utilization of small-footprint, high-bandwidth plasmonics structures with the low-loss functional potential offered by the more mature SOI technology. PLATON will evolve upon a whole new generation of miniaturized photonic components including: (a) a new series of fast 2x2 thermooptic plasmonic switches, (b) a small-footprint 4x4 thermooptic plasmonics switch, (c) an optically addressable 1x2 plasmonic switch operating at bitrates in excess of 10Gb/s, and (d) a 2x2 and a 4x4 Tb/s optical routing platforms. To this end, PLATON will pioneer the field of routing for optical interconnects and will provide a completely new technological toolkit, bringing Europe in a leading position world-wide with respect to research efforts in plasmonics for interconnects. Finally, it will open totally new application vistas and opportunities for European industry being active in the field of nanophotonics, given that the active participation of industry within PLATON ensures the industrial take up of the combined plasmonics/photonics functional devices from research elements to commercially available products.

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**NBR: 249169** **ACRONYM: NANOICP** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2009-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Self-organized TiO2 nanotubes-intrinsically conductive polymer composite material for applications in solar cells, biomedicine systems, and electro-chromic devices

**Abstract:** This project aims to develop new generation of composite material based on TiO2 nanotubes and intrinsically conductive polymer (ICP) deposited in nanotube framework. Our objective is to combine of electrical conductivity of ICP and UV sensitivity of TiO2. Particularly, dye sensitization of TiO2 in conjunction with ICP is of our interest. It is expected that high surface area morphology offered by high aspect ratio nanotube system, which provide extremely high TiO2/ICP interface, will play the key role in specific interaction between conductive polymer and wide band-gap semiconductor. Remarkable electric and optical properties of new composite material are expected. A variety of polymer dopants, electrochemical conditions, and electropolymerization

methods will be applied in order to find electrochemical route for successful, homogeneous deposition of ICP`s in TiO2 nanotube system. Two conductive polymers will be electrosynthesized in nanotube framework: poly-3,4-ethylenedioxytiophene (PEDOT) and poly-3-hexyltiophene (P3HT). The p-n junction, which is expected at the polymer-semiconductor interface, will be electrochemically controlled by switching polymer between oxidizing and reducing state. PEDOT will be tested as a p-type electrolyte in dye sensitized solar cell device Ti/TiO2/ruthenium-based-dye/PEDOT. P3HT absorbs visible light and thus may replace the dye and the electrolyte, giving the function of charge transport and light absorption. The effects of nano-architecture of the Ti/TiO2/P3HT composite material will be studied in order to meet the dimension of phase separation within the exiton diffusion length of the polymer. Above features make the new composite material very attractive for applications including solar cells and electro-chromic devices. Furthermore, improved bio-compability of the material should find practical applications in biomedicine systems. This project will be taken in close collaboration of Hokkaido University and University of Erlangen.

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**NBR: 249196** **ACRONYM: NEMSMART** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2009-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Development of High-Performance and High-Reliability NEMS Switches for Smart Antenna Structures

**Abstract:** This project focuses on the development of high-reliability low-contact force DC-contact, i.e., metal-to-metal contact RF-NEMS (Radio Frequency Nanoelectromechanical System) switches, which are the main building blocks of key enabling component of the next-generation cognitive wireless communications systems, i.e. the interface between the transceiver and the free space; namely NEMS-integrated multifunctional reconfigurable antenna (MRA). An MRA combines multiple functions into a single antenna with the capability of dynamically altering its radiation, polarization, and frequency characteristics. The reconfigurability in performance properties is achieved by morphing the physical structure of the MRA through DC-contact RF-NEMS switches. The major objective of this project is to significantly improve the reliability of DC-contact RF-NEMS switches with high RF-power handling capabilities. To this end, we will optimize the mechanical switch design using novel architectures, investigate different electric contact metallurgies, employ nanoparticle-based lubricants, and develop new nanofabrication processes optimized for avoiding two primary failure mechanisms: stiction and increased contact resistance. The targeted actuation voltage and the switching speed are less than 10 Volts and faster than 100 nano-seconds, respectively. Hot-switched life cycle tests for various RF-power levels will be performed, with the goal of achieving more than 108 hot-switched cycles at 1-Watt RF-power. The proposed high-reliability NEMS switches, once successfully developed, can be easily integrated into antenna architectures to

realize MRAs, thereby resulting a major breakthrough in antenna design and implementation since the invention of legacy antennas by Marconi and Hertz.

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**NBR: 249209** **ACRONYM: STSON NANOSTRUCTURES** **EC FUND: 45000**

**DG:** REA **Call: FP7-PEOPLE-2009-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Investigation of the electronic properties of nanostructures at the atomic scale by means of low temperature scanning tunneling microscopy/spectroscopy in ultrahigh vacuum conditions

**Abstract:** The main goal of the research project that I propose for the next three years is the study of the electronic properties of nanostructures at the atomic scale. The investigation will be performed by means of low temperature scanning tunnelling microscopy/spectroscopy in ultrahigh-vacuum environments (UHV-LTSTM), a unique technique which allows the study of these electronic properties in a local way with atomic resolution. Thanks to this technique it will be possible to get the local electronic information of the nanostructures with ultimate energy resolution (<1meV) and also to modify the systems in a controlled way by direct manipulation using the STM tip. This will open the possibility to selectively modify the local environment of the nanostructures to study and also to create new nanostructures using as elemental building-blocks atoms and/or individual molecules. The investigation will be structured in three main research lines: On one side the electronic properties of nanostructures electronically decoupled from the substrate by means of ultrathin insulating films will be studied Two main kind of nanostructures will be examined; bidimensional metallic films and molecules both in single and self-assembled arrangements. In a second line these same nanostructures, now adsorbed on epitaxial graphene, will be investigated. Special emphasis will be put in the influence of the Dirac quasiparticles of graphene in the electronic properties of the nanostructures and also in understanding and/or controlling how the adsorption of these nanostructures locally or even globally modify the electronic properties of graphene itself. The third research line will be focused on the study of phase transitions in the metal semiconductor systems Pb/Si(111), Pb/Ge(111) and Sn/Ge(111) at 4K. One of the fundamental questions to understand the temperature evolution of these 2D systems is precisely to know which is the true ground state at the lowest temperature.

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**NBR: 249211** **ACRONYM: NARCISUS** **EC FUND: 30000**

**DG:** REA **Call: FP7-PEOPLE-2009-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Noncoding RNA Comparative Searching System

**Abstract:** Beside these well-known molecules there is a vast unknown world of tiny RNAs (RiboNucleic Acids) that might play a crucial role in a number of cellular processes. Those elements are named noncoding RNAs (ncRNA) and they play their function without transcription to the protein product. Here is proposed development of integrated bioinformatics platform that is specifically addressed for detecting, verifying, and classifying of noncoding RNAs. This complex approach to "Computational RNomics" will provide the pipeline which will be capable of detecting RNA motifs with low sequence conservation. It will also integrate RNA motif prediction which should significantly improve the quality of the RNA homolog search. The first commercial application is the integrated system for detection of new regulatory elements located in the non coding genome parts. Up to now numerous human disorders have been found to be related to some of the noncoding RNA's The second application of the project is so called RNA nanotechnology. It is designing of artificial nanoparticles, which are assembled mainly from ribonucleic acid which possess both the right size and ability to gain entry into cells and halt viral growth or cancer's progress or deliver drugs. The project will benefit from latest achievements in High Performance Computing and General-Purpose computing on Graphics Processing Units and Graph theory.

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**NBR: 249216** **ACRONYM: COMHMAT** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2009-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Computational study of hydrogen storage in metal-doped materials

**Abstract:** The efficient storage of hydrogen is the bottleneck in the development of fuel-cell powered vehicles. Currently, technical targets for hydrogen storage capacity have not been met by any existing technology. The European Union has set research needs for hydrogen storage in very high priority in view of the expected benefits of fuel cells in facing the global warming problem. Experimental studies have concluded that a promising method for storing hydrogen is by adsorption in metal-doped porous materials. Physically, in this method, the metal nanoparticles cause dissociation of hydrogen gas and H atoms subsequently migrate to the porous adsorbent. The phenomenon is called spillover and its mechanism is currently not understood. We aim to use a multi-scale modeling approach, consisting of ab-initio DFT calculations, Monte Carlo simulations and macroscopic modeling, in order to: a) Understand the mechanism of spillover and the effects of material properties and operating conditions. b) Quantify the capacity of hydrogen storage by spillover on a variety of metal-doped porous materials, including graphitic materials, carbon nanotubes, carbon foams, graphite-oxide materials, metal-organic frameworks and covalent-organic frameworks) c) Predict materials that would be expected to have high hydrogen storage capacities through the mechanism of spillover.

**NBR: 249225** **ACRONYM: GNRSENSE** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2009-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Graphene nanoribbon based chemical sensors

**Abstract:** Significant progress and novel discoveries have been made in the past two decades in the science of nanometer scale carbon based materials. Novel physical phenomena characterizing low dimensional systems have been discovered leading to the development of prototype devices. Graphene nanoribbons have very recently emerged at the front of this field due to their unique electronic, magnetic and mechanical properties and the ability to fabricate them in a controllable and reproducible manner. Despite the considerable progress that has been made in the controlled fabrication and the understanding of the physical properties of graphene nanoribbons, currently, much less is known regarding their chemical nature. The large surface to volume ratio and the existence of reactive edges are expected to considerably enhance their chemical reactivity with respect to related systems such as carbon nanotubes and infinite graphene surfaces. Thus, understanding the surface and edge chemistry of graphene nanoribbons and utilizing it for chemical sensing purposes is a major challenge. It is the purpose of this research program to address this challenge. To this end, our proposed program will focus on the development and implementation of a new model that will allow the accurate treatment of the electronic and transport properties of finite extended systems such as graphene nanoribbon surfaces. Using this model we will study in depth the process of molecular adsorption on the surface and edges of nanoribbons and its influence on the electronic properties of the ribbon. Furthermore, we propose to study new schemes to control the reactivity of the ribbon and the selectivity of the adsorption process. We believe that the proposed research program will enhance the understanding of the chemical nature of graphene nanoribbons and will provide guidelines for the design and fabrication of novel nanoscale sensing devices.

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**NBR: 249259** **ACRONYM: III-V NWS ON SI** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2009-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Self-assembled growth of IIIâ€“V Semiconductor Nanowires on Si for Future Photonic and High Electron Mobility Applications

**Abstract:** Apart from the never–ending miniaturization of higher–performance semiconductor devices, two major routes will be required to significantly push the Si semiconductor technology of today beyond its limits: the integration of low–cost Si technology with

other high–performance materials and the use of new nanoscale device structures, where photonic and electronic units can exploit new functionalities via quantum physical effects. This project will merge these two important routes, aiming at the integration of III–V compound semiconductor nanostructures on Si for next–generation device applications. We will employ the gallium–arsenide (GaAs) compounds as highly efficient III–V materials due to their ultra–high carrier mobilities, superior optoelectronic properties and band gap engineering potentials. For nanoscale model systems we will incorporate these materials in the form of one–dimensional nanowires (NWs), which benefit from dimensions smaller than the emission wavelength, but also from their nearly defect–free singlecrystalline quality achieved via self–assembled growth. We will employ sophisticated molecular beam epitaxy (MBE) growth techniques to synthesize high–quality arsenide–based NWs on Si (111) via catalyst–free nucleation. The growth kinetics effects and selective area epitaxy will be directly correlated with extended materials characterization for optimization of structural, optical and electronic performance. Basic NW structures will then be extended toward advanced core–shell NW heterostructures for two complementary topics, (i) near–IR nanophotonic emitters with tunable–bandgap emission, and (ii) ultra–high electron mobility NW device structures, in particular field effect transistors (FETs). With detailed physical investigations and proof–of–principle demonstrations of such state–of–the–art device structures, we will provide significant insights toward the integration of nanoscale III–V heterostructures with Si.

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**NBR: 249262** **ACRONYM: CRYOMAS4DNP** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2009-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Cryogenic Magic Angle Spinning For Nuclear Dynamic Polarization

**Abstract:** We intend to develop a new nano-characterization technique able to complement the tools currently available (AFM, TEM, XPS etc.) and to palliate the inadequacies and/or sensitivity limitations of atomic resolution techniques such as X-ray diffraction and solution NMR. Indeed, despite their success to resolve structures, they do not contribute as much to the tremendous ongoing advances in nanoscience: i.e. development of molecular memories, molecular electronics, nano-biosensors, etc. The reason relies mainly in the intrinsic nature of the samples involved (either non-crystalline or insoluble materials) and the subsequent poor detection sensitivity associated. The objective of the project is to develop a particular form of solid-state Nuclear Magnetic Resonance able to enhance the nuclear spin sensitivity by 4 to 6 orders of magnitude. To achieve this objective, we will use a high power microwave source to irradiate the unpaired electron spins (contained in optimized polarizing agents) in order to hyperpolarize surrounding nuclear spins through a mechanism called Dynamic Nuclear Polarization (DNP). The experiments will be conducted at high magnetic field, with a temperature ranging from 10 to 300 K and rotation of the sample at the magic angle in order to retain high

resolution NMR conditions. The project also intends to demonstrate the pertinence of the approach for atomic structure determination of challenging nano-systems beyond reach by other techniques, e.g. functionalized nanotubes/molecular wires, paramagnetic systems (porphyrins, proteins, etc.) as well as very large non-crystalline and insoluble biomolecular systems.

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**NBR: 249303** **ACRONYM: SMILE** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2009-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Combination of Shear Stress and Molecular Imaging of Inflammation to Predict High-Risk Atherosclerotic Plaque

**Abstract:** Although the detailed pathophysiologic triggers responsible for the individual natural history trajectory of each atherosclerotic plaque are unknown, the local, dynamic interplay between low endothelial shear stress (ESS) and vascular inflammation is likely to be critical. The purpose of the proposed project is to combine ESS with inflammation in a plaque risk classification scheme aiming to predict high-risk plaque at early stages of its development before its rupture. Enhancing our understanding of the magnitude of local hemodynamic stimulus with respect to inflammation (i.e. ESS), as well as the extent of local inflammation would allow us to detect early, minimally stenotic, atherosclerotic lesions and stratify the risk of them evolving into high-risk plaques. The latter classification is of utmost clinical importance as it can provide a rationale for innovative diagnostic and/or therapeutic strategies for the management of coronary patients, as well as the prevention of acute coronary syndrome. Identification of a high-risk plaque at its early stages of development would potentially justify highly selective, prophylactic local interventions, such as implantation of stents or targeted nanoparticle-based delivery of anti-inflammatory drugs, supplemented by an intensive systemic pharmacologic approach to limit the severity of inflammation, stabilize the plaque, and thereby avert a future acute coronary event. The clinical and economic implications of identifying and treating high-risk individual coronary lesions before an adverse cardiac event can occur are anticipated to be enormous.

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**NBR: 249319** **ACRONYM: SUPRACRYST** **EC FUND: 45000**

**DG:** REA **Call: FP7-PEOPLE-2009-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Self-Assembly of DNA-Functionalized Nanoparticles: a viable approach towards Supramolecular Crystals

**Abstract:** Research towards 2D and 3D supramolecular crystal engineering is expected to play a key role in the development of controlled bottom-up fabrication of nanostructured devices. The ability to predict the self-assembly at different length scales, ultimately allowing to attain a full control over the interplay of kinetics and thermodynamics ruling the hierarchical self-assembly in inorganic and biological systems, is a fundamental prerequisite to the progress of the field. SUPRACRYST aims at contributing to the advance of such a central technological field in Europe, and in particular it will focus on the development of new DNA- and nanoparticle-based devices. The final goal will be the controlled engineering of 2D and 3D supramolecular crystals made of inorganic nanoparticles linked through the recognition of DNA single strands. The possibility of interfacing DNA with gold and magnetic nanoparticles, controlling both the geometry and the valence, will be explored. Structural DNA nanotechnology has opened up perspectives for the directed self-assembly of nanoparticles into patterned nanostructures that can lead to promising applications, such as photonic antennas and controlled plasmonic interactions. In this framework, the high-fidelity of DNA pairing code is exploited to program the assembly schemes, and single-stranded DNA (ss-DNA) will be used as couplings arms to steer the assembly of nano-units into functional 2D or 3D assemblies. The formation of ordered and disordered self-assembled condensed phases and their dependence on geometry and valence will be investigated. Controlling the length and flexibility of the binding DNA arms, as well as the architecture of the bonding pattern via the use of spacers and linkers, we aim to manipulate the obtained crystal structures and to tune the characteristic lattice spacing toward arrays of low nanoparticle density.

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**NBR: 249835** **ACRONYM: TERNANOMED** **EC FUND: 2198799**

**DG:** ERCEA **Call: ERC-2009-AdG** **Thema:** ERC-AG-LS7

**Title:** TERPENOYLATION: AN ORIGINAL CONCEPT FOR THE DISCOVERY OF NEW NANOMEDICINES

**Abstract:** Terpenoids are a group of natural compounds that are extraordinary diverse in chemistry, structure and function. Most of the natural terpenoids are flexible and biocompatible biopolymers, having physico-chemical characteristics able to adapt to a wide variety of biologically active compounds. Surprisingly, they have never been used previously in the nanotechnology field for drug delivery and targeting purposes, except very recently by us to design squalene-based nanoassemblies. Thus, the current project aims to develop terpenoid-based nanoassemblies to improve the treatment of severe diseases incl. cancer, infectious and metabolic diseases. The conceptual approach is to chemically link a terpenoid to a biologically active drug molecule in order to allow the resulting bioconjugate to self-assemble as nanoparticles in water. Noteworthy, the nature of the polyterpenoid (ie. number of isoprenoid units) may be adapted to the hydrophilic/lipophilic character of the drug molecule to be transported, whereas the

nature of the linkage (ester, amide, disulfide bonds etc.) will be selected according to the enzymatic content of the targeted diseased area. From the ratio between drug s and polyterpene s molecular weights, it is deduced that the drug loading will be dramatically improved as compared to the currently available nanomedicines. In other words, the pro-drug will form the nanomedicine by selfaggregation without the need of any other transporter material. The project will involve the following interdisciplinary aspects:(i) synthesis of drug/polyterpene bioconjugates,(ii)design of the nanoassemblies and their functionalization with recognition ligands,(iii)cell and tissue imaging and(iv)pharmacological evaluation in vitro (cell culture) and in vivo. Such ambitious and challenging project will be performed under Patrick Couvreur s leadership who has settled up a worldwide recognized multidisciplinary research team, unique in the nanomedicine world.

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**NBR: 249867** **ACRONYM: OPTONEURO** **EC FUND: 2190000**

**DG:** CNECT **Call: FP7-ICT-2009-C** **Thema:** ICT-2009.8.0

**Title:** Optogenetic Neural stimulation platform

**Abstract:** The 2003 breakthrough discovery of a nanoscale optically active cation channel, channelrhodopsin-2, made it possible for the first time, to genetically re-engineer neuron cells to be photosensitive. It became possible to stimulate or inhibit individual action potentials at will, without further chemical modification. The capabilities have been demonstrated in a number of recent high profile journals detailing optical-neural control from cell culture to primate models. The light-gated cation channels were discovered and first applied by European researchers. The photonics and optoelectronics sectors, which can provide new stimulation technologies to this field, are additionally, European strengths. Nevertheless, in recent years, the dominant research output in this area has shifted to well-funded US laboratories. This proposal therefore aims to create a consortium to develop an array of ultra bright electronically controlled microLEDs which will provide a truly revolutionary tool for the neuroscience and neurotechnology community. The consortium consists of experts in the field who converge the many disciplines (optics, sophisticated LED fabrication, CMOS flip chip design and bonding, biophysics, molecular biology, neurophysiology) to bear on the complex, and crucial to neuroscience, problem of studying dendritic physiology and neural network dynamics. Advances in the techniques of this field will absolutely be required to further our understanding of brain function. The system we propose to develop will be powerful, sophisticated and at the same time, lead to a commercial spin-out that will provide them at relatively low cost. In the longer term, the tools we develop in this proposal will hasten our long term aims of developing an optogenetic retinal prosthesis.

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**NBR: 249930** **ACRONYM: CORALWARM** **EC FUND: 3332032**

**DG:** ERCEA **Call: ERC-2009-AdG** **Thema:** ERC-AG-ID1

**Title:** Corals and global warming: The Mediterranean versus the Red Sea

**Abstract:** CoralWarm will generate for the first time projections of temperate and subtropical coral survival by integrating sublethal temperature increase effects on metabolic and skeletal processes in Mediterranean and Red Sea key species. CoralWarm unique approach is from the nano- to the macro-scale, correlating molecular events to environmental processes. This will show new pathways to future investigations on cellular mechanisms linking environmental factors to final phenotype, potentially improving prediction powers and paleoclimatological interpretation. Biological and chemical expertise will merge, producing new interdisciplinary approaches for ecophysiology and biomineralization. Field transplantations will be combined with controlled experiments under IPCC scenarios. Corals will be grown in aquaria, exposing the Mediterranean species native to cooler waters to higher temperatures, and the Red Sea ones to gradually increasing above ambient warming seawater. Virtually all state-of-the-art methods will be used, by uniquely combining the investigators expertise. Expected results include responses of algal symbionts photosynthesis, host, symbiont and holobiont respiration, biomineralization rates and patterns, including colony architecture, and reproduction to temperature and pH gradients and combinations. Integration of molecular aspects of potential replacement of symbiont clades, changes in skeletal crystallography, with biochemical and physiological aspects of temperature response, will lead to a novel mechanistic model predicting changes in coral ecology and survival prospect. High-temperature tolerant clades and species will be revealed, allowing future bioremediation actions and establishment of coral refuges, saving corals and coral reefs for future generations.

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**NBR: 250071** **ACRONYM: EUKARYOTIC RIBOSOME** **EC FUND: 2446725**

**DG:** ERCEA **Call: ERC-2009-AdG** **Thema:** ERC-AG-LS1

**Title:** Structural studies of the eukaryotic ribosome by X-ray crystallography

**Abstract:** The ribosome is a large cellular organelle that plays a central role in the process of protein synthesis in all organisms. Currently, structural information at atomic resolution exists only for bacterial ribosomes and some of their functional complexes. Eukaryotic ribosomes are larger and significantly more complex than their bacterial counterparts. They consist of two unequal subunits with a combined molecular weight of approximately 4 million Daltons and contain 70-80 different protein molecules and four different RNAs. Currently the only structural information on eukaryotic ribosomes is

available from cryo electron microscopic reconstructions in the nanometer resolution range, which is insufficient to derive information about the function of the eukaryotic ribosome at the atomic level. The aim of this proposal is to use X-ray crystallography to obtain structural and functional information on the eukaryotic ribosome and its functional complexes at high resolution. The key targets of the structural work will be: i) the structure of the small ribosomal subunit, ii) the structure of the large ribosomal subunit, and iii) structures of complexes involved in the initiation of protein synthesis. Besides the obvious fundamental importance of this research for understanding protein synthesis in eukaryotes the proposed studies will also be the prerequisite for understanding the structural basis of the regulation of protein synthesis in normal cells and how it is perturbed in various diseases. Finally, comparing the structures of bacterial and eukaryotic ribosomes is important for understanding the specificity of various clinically used antibiotics for the bacterial ribosome.

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**NBR: 250319** **ACRONYM: ORGENECHOICE** **EC FUND: 2500000**

**DG:** ERCEA **Call: ERC-2009-AdG** **Thema:** ERC-AG-LS5

**Title:** Regulation of the expression of odorant receptor genes in mouse

**Abstract:** Odorant receptor (OR) genes form the largest family in the mouse genome: ~1200 genes spread over ~40 loci. Each olfactory sensory neuron (OSN) expresses one OR gene, from one allele. The mechanisms of OR gene choice remain elusive. We will execute five specific aims that are interconnected but independent. We will search for homeodomain genes that we can link functionally to expression of a subset of OR genes; we will define promoter regions for the eight OR genes that are solitary, not belonging to a cluster; we will look for organizational principles among the repertoire of second choices in OSNs that express first an OR locus without a coding sequence; we will characterize the phenotype of mice with a knockout of a novel regulatory element, the P element; and we will test the distance-dependence of the activity of this and a similar element (the H region) by transplanting it within the local genomic region. Guiding hypotheses are that promoter regions for OR genes are short and close to the coding sequence; that the conserved homeodomain and O/E binding sites in OR promoter regions have a fundamental role in OR gene choice, rather than in transcription after it is chosen for expression; and that the H and P elements are two of several similar regulatory elements that each operate in cis within a cluster. The approach is based on gene targeting and transgenesis by pronuclear injection. A multipronged strategy will be taken to assay OR gene expression, with βgal-reporter mice, in situ hybridization, custom Affymetrix microarrays for mouse ORs, quantitative, real-time PCR, and Nanostring molecular bar codes. Understanding OR gene choice will have implications for our understanding of the regulation of gene expression in the mammalian genome – particularly if new mechanisms or principles are discovered.

**NBR: 251131** **ACRONYM: DYNEFI** **EC FUND: 180470**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** Dynamic Near Field Imaging

**Abstract:** Dynamic Light Scattering is a widespread technique for measuring fluid properties in soft matter. It is used to investigate complex fluids, colloids, proteins, nano-particles, but also samples of bio-physical and medical interest. The advent of pixilated sensors like CCD cameras and fast computers allowed the design of different imaging techniques aimed at providing the same quantitative information. Dynamic Near Field Imaging (DyNeFI) is a family of novel optical techniques of this kind. Different variants of this new approach have been successfully designed and used for very refined measurements, nevertheless the soft matter community is not aware of this intriguing possibility. The proposed project aims at: increasing the measuring capabilities of DyNeFI by the integration of new measuring concepts, applying it to samples coming from different research areas thus providing new science and starting developing instruments which can be commercialized in a next future. Essentially the project can be divided into three modules: A) Investigation of the dynamics of the transition between capillary waves and non equilibrium fluctuations in a critical binary mixture undergoing phase transition in order to get deeper insight of the dissolution of an interface between two fluid phases and also provide a tool to measure the effective surface tension B) Application of the technique to micro-rheological measurements, in order to compare the Dy-NeFI technique with other tools for measuring the viscoelastic properties of complex fluids C) Extension of the technique to fast dynamics, through Micro Mirror Device concept, in order to overcome the major disadvantage of the technique, which is the limited ability to investigate fast dynamics

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**NBR: 251149** **ACRONYM: QUASINANO** **EC FUND: 769672**

**DG:** REA **Call: FP7-PEOPLE-2009-IAPP** **Thema:** FP7-PEOPLE-2009-IAPP

**Title:** Quantum-mechanical simulations for the nanoscale

**Abstract:** A leading scientific software company and a renowned university research group will jointly develop new, quantum-theory based methods and concepts to allow quantum-mechanical computer simulations of systems in the 100,000 atoms range, and apply them to study challenging applications. As a result, a new chapter of atomistic computer simulation will be opened, as quantum-mechanical simulations will become feasible to study systems and processes in nanotechnology, biochemistry, supramolecular and

inorganic chemistry, and in particular interfaces between these domains. SCM N.V. is an SME founded in 1998 as a spin-off of the VU University in Amsterdam, and has developed since then into one of the market leaders for quantum chemical software. The Computational Materials Science group of Prof. Heine at Jacobs University has a long experience in nanomolecular sciences, including organic and inorganic nanomaterials, spectroscopy, dynamic effects etc. The project is based on recent developments of the Heine group, which rely on an approximate DFT (A-DFT) method which is applicable throughout the periodic table, and which is capable of dealing with systems in the 100,000 atoms range. For highly accurate simulations and spectroscopy, a related hybrid method between DFT and A-DFT (AxDFT) will be developed. The methods will be brought through secondments to SCM where they will be implemented into its software product ADF and brought into the market. The resulting software will be used for challenging applications in the fields of nanoelectromechanics, supramolecular and inorganic chemistry, and nanoporous materials. With this initiative ADF will become significantly more competitive and SCM will strengthen its position on the market of quantum-theory based computer software, which is currently dominated by US-based enterprises. Knowledge is exchanged through extensive secondments of ERs, ESRs and staff ERs. Two workshops are planned to disseminate the product.

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**NBR: 251276** **ACRONYM: ULTRATUNE** **EC FUND: 238482**

**DG:** REA **Call: FP7-PEOPLE-2009-IIF** **Thema:** FP7-PEOPLE-2009-IIF

**Title:** High-power, low-noise, ultrafast tunable laser sources using supercontinuum generation

**Abstract:** This proposal aims to research and develop a novel tunable ultrafast pulse laser source for use in biomedical applications. Covering the wavelength range from 400 nm to over 1650 nm, and delivering compressed pulses as short as sub-30 fs, the realisation of such a laser source will advance the state-of-the-art by achieving the combination of two key features, high-power and low-noise, which is not achievable using other current approaches. The research approach is to exploit the latest developments in solid-state lasers combined with recent advances in fiber technologies providing a new high-performance architecture. Saturable semiconductor absorber devices acting as nonlinear mirrors (SESAMs) will mode-lock an efficient solid-state ultrafast oscillator to provide compact, robust, low-noise, multi-Watt level seed pulses. Broadband tunability will be obtained via supercontinuum generation in novel microstructured fibers. This new architecture combines synergistically the skills of the host institute (stable SESAM-based lasers) and the researcher (ultrashort pulse generation, manipulation, and control). Within the project, I plan to explore biomedical applications of this novel laser technology in microscopy imaging, nanosurgery, and dentistry in collaboration with international EU partners. These laser sources are likely to have many additional applications outside of the biomedical market. The work will be performed by a researcher from USA with more than 10 years of experience in ultrafast lasers; the last 4

years were with the Ultrafast group at Coherent Inc., an established world leading commercial supplier of ultrafast lasers, and previously 5 years within the College of Optics - CREOL, in the internationally-recognized group of Prof Peter Delfyett. The researcher will be hosted by Time-Bandwidth Products AG at Zurich, Switzerland, a pioneering SME in robust, reliable, high-power, low-noise SESAM mode-locked ultrafast solid-state lasers.

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**NBR: 251307** **ACRONYM: IRMED** **EC FUND: 856415**

**DG:** REA **Call: FP7-PEOPLE-2009-IAPP** **Thema:** FP7-PEOPLE-2009-IAPP

**Title:** Intelligent recognition materials for extraction and detection

**Abstract:** This project will focus on the development and optimisation of intelligent recognition materials for applications in extraction and detection, focusing on the molecular imprinting approach. Three key scientific aims have been identified: (i) development and optimization of imprinted polymers; (ii) MIPs and applications to the market (iii) new concepts and innovative thinking in intelligent recognition materials. This partnership brings together three teams from France and the United Kingdom. The scientific interests of these groups have a common denominator in the application of molecular imprinting for the preparation of new intelligent materials and the use of these materials in synthesis, catalysis and assay devices while the scientific background of the groups is divergent ranging from bioengineering and nanobiotechnology to synthetic chemistry and polymer chemistry all the way to product oriented research and technology R&D. The transfer of knowledge program has been devised taking into account the three main objectives of this partnership, that are (T1) scientific ToK; (T2) professional development; (T3) long term collaborations. The partnership has identified five key actions along which the program will develop, and these are i) secondment of researchers, ii) recruitment of new researchers, iii) partnerships events, iv) return home plan, v) interactions between principal investigators. The field of molecular imprinting has now reached an important stage where further technological advance will require closer interactions of academia and industry. Researchers with broad competences in chemistry, chemical technology as well as product development are needed to bring this promising and truly European technique into its new stage of application and commercialisation. The close collaboration between academic teams and an SME fully involved in this area, working together on this project will provide the ideal platform.

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**NBR: 251380** **ACRONYM: MANON** **EC FUND: 752481**

**DG:** REA **Call: FP7-PEOPLE-2009-IAPP** **Thema:** FP7-PEOPLE-2009-IAPP

**Title:** Methods for Advanced Multi-Objective Optimization for eDFY of complex Nano-scale Circuits

**Abstract:** Cost control, production efficiency, cycle time and yield are critical quality benchmark for nanoelectronics productions. An increasingly important downside of nano-CMOS technology scaling is the fact that the scaling of feature sizes cannot be accompanied by a suitable scaling of geometric tolerances. In addition, when getting into deep miniaturized dimensions, phenomena like edges or surfaces roughness, or the fluctuation of the number of doping atoms within the channels are becoming increasingly significant. As a result, the figures of merit of a circuit, such as performance and power, have become extremely sensitive to uncontrollable statistical process variations (PV). To ensure stable manufacturability and secure high manufacturing yield, it is mandatory to manage complete design flows and to link traditional methods for design with Technology CAD models. In this context, multi-objective optimization algorithms and statistical analysis are essential on device and behavioral levels to secure high yielding by modeling the impact of inevitable process variations and doping fluctuations on IC performance. Statistical circuit modeling is a viable solution to nano-electronics production quality, on which the European Union is already investing. The project intends to create a partnership between academies, industry and SME so to create a Transfer of Knowledge between the organizations in order to pass the mathematical know how on multi-objective optimization, symbolic techniques and numerical statistical simulation on one side, the industrial design experience, real test cases availability and Electronic Design Automation (EDA) software modeling skills on the other. The scope of the research activity will be to create PV-aware and PV-robust circuit design techniques, tools and models in the frame of the analogue and mixed-signal circuit industrial design.

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**NBR: 251391** **ACRONYM: COLDBEAMS** **EC FUND: 964781**

**DG:** REA **Call: FP7-PEOPLE-2009-IAPP** **Thema:** FP7-PEOPLE-2009-IAPP

**Title:** ultra-COLD gas for the production of a Bright Electron And Monochromatic ion Source

**Abstract:** The objective of COLDBEAMS is to increase knowledge-sharing and mutual understanding between two Academic partners, Laboratoire Aimé Cotton (LAC), France and Dipartimento di Fisica of the Università di Pisa (UNIPI), Italy, and one SME, Orsay Physics (OP), France. The technical-scientific focus of this strategic partnership is on the development of a new electron and ion source based on ionized ultra-cold atoms. The use of this revolutionary incident source could create a real breakthrough in the Focused Ion Beams (FIB) or in energy electron source technology with substantial improvements in terms of monochromaticity, brightness and minimum spot size. The joint research project is designed to exploit complementary expertise of the participants and to create synergies between them. Orsay Physics is one of the leading companies in realization

and commercialization of FIB and start to commercialized UHV focused electron beam columns, dedicated to surface analysis systems. Thus, the OP team should provide the partners the know-how on the ion/electron optics, electronics and industrial production requirements. OP will also provide the industrialization of a prototype and its commercialization. LAC from the Centre National de la Recherche Scientifique (CNRS), is the co-ordinateur of the project and, as the UNIPI, team is specialized in laser cooling of atoms. The LAC, is also specialist in ultra-cold plasma physics wheras the UNIPI is specialized on nanolithography through laser-cooled atomic beams. Thus, the LAC and UNIPI team should provide to OP the know-how on cold atom technology. The LAC team should develop the sources for Focused Ion and Electron Beams based on cold atom technology, why the UNIPI team should develop an ion source, but capable to be complementary to the LAC one, in particular develop a tool for the "single ion on demand" implantation.

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**NBR: 251420** **ACRONYM: REPLIXCEL** **EC FUND: 2591172**

**DG:** REA **Call: FP7-PEOPLE-2009-IAPP** **Thema:** FP7-PEOPLE-2009-IAPP

**Title:** Highly efficient new generation synthetic RNA-replicon based vaccine

**Abstract:** The project seeks to create a novel, efficacious vaccine against influenza virus; a new type of synthetic vaccine readily adaptable to meet whichever influenza virus subtype may arise. A new generation of RNA-replicon technology will be employed combined with nanoparticles and innovative adjuvants for targeting of dendritic cells and efficient antigen expression. The consortium comprises two SMEs and two academic institutions each having unique and patented expertise such as replicon technology, nanoparticle technology, adjuvant chemistry, and surface modification chemistry to attach targeting moieties. As a highly interdisciplinary project, extensive exchange of knowledge between the project partners will be required in particular between product focused SMEs (nanoparticles, adjuvants) and technology excellence of academic institutions (replicon technology, surface modification chemistry).

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**NBR: 251429** **ACRONYM: UNCOS** **EC FUND: 520116**

**DG:** REA **Call: FP7-PEOPLE-2009-IAPP** **Thema:** FP7-PEOPLE-2009-IAPP

**Title:** Unique Nanocarbons from Critically Opalescent Solutions

**Abstract:** The principal focus of this project is to synthesise carbon nanomaterials and composites with enhanced mechanical and electrical performance using a novel alternative technology. Carbon nanoparticles and polymer composites are formed from the

dissociation of critically opalescent fluids via a UV laser. The aim is to produce such materials in a continuous process where the produced material or composite material is synthesised with its final desirable properties in a single to low number of chemistry steps. The project explores the potential of this novel process for the production of new carbon nanomaterials in close collaboration between an academic partner and an SME with the objectives to produce various carbon nanostructures from critically opalescent fluids, to produce carbon nanomaterials with increased electric conductivity, to produce composite materials with improved mechanical properties, to characterise the properties of the produced carbon nanomaterials, to optimise the process conditions and control the resulting structure of the carbon materials, to develop processes suitable for industrial application, to establish new links between academia and SME, to provide access to academic knowledge and infrastructure to industrial partner and vice versa, and to provide staff in industry and academia with transferable skills. The work programme to achieve these goals includes production of novel carbon nanomaterials from carbon dioxide in batch process (specifically carbon nanotubes, carbon nanofibres, carbon platelets, graphene, carbon layers with controlled dielectric properties, and cross-linked polymer composites), construction of a carbon dioxide reactor system for continuous flow process, production of carbon nanomaterials in continuous flow process, analysis of novel carbon nanomaterials, market analysis, risk assessment, selection and optimization of processes for scale-up, and an intensive knowledge transfer programme.

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**NBR: 251477** **ACRONYM: CNTF COMPOSITES** **EC FUND: 666148**

**DG:** REA **Call: FP7-PEOPLE-2009-IAPP** **Thema:** FP7-PEOPLE-2009-IAPP

**Title:** CNTF (Carbon Nano Tube Fibres) COMPOSITES

**Abstract:** Carbon nano tubes (CNT) are nano-scale materials with exceptionally high mechanical, electrical and thermal conductivity properties. For example the Tensile strength of a single walled nano tube is ~ 1TPa. The thermal conductivity at room temperature for single Multiwalled CNT was measured to be greater than 3000 W/m•K and perfect CNT are also able to conduct electrons without heat loss. Most of the known properties related to CNT's come from the investigation of a single CNT while the main goal remains to exploit those properties in the macro scale through the use of highly oriented and aliened CNT's. It is possible to exploit the exceptional properties of CNT by producing fibres which are based on CNT's as building blocks. These kinds of fibres may be called CNT fibres or CNTF. One approach to produce CNTF is the process of spinning from a CVD process. This process was selected as a potentially applicable process for industrial scale production of CNTF. It has been proved that scale up of the process is feasible while maintaining an affordable and stable process suitable for large scale manufacturing. In order to cross the gap between feasibility in the lab scale and industrial pilot a research effort needs to be carried out in this field. The CNTF by itself is

a material suitable for various engineering applications. This is achieved due to the fact that in the CNTF all the remarkable characteristics of CNT's are expressed. Another route to exploit the material properties of the CNTF's is to incorporate them in a polymeric matrix to result in a CNTF based composite material. Since we are dealing with a new and innovative fibre type further research is needed in order to find and optimize the polymeric matrix type for the various applications suggested. These applications are: structural and conductive composites, composites for the automotive industry, composites for the aviation industry and even as an armour material.

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**NBR: 251698** **ACRONYM: 3DMAGNANOW** **EC FUND: 172740**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** Fabrication of three dimensional magnetic nanowires for information storage

**Abstract:** The objective of the proposal is the fabrication and study of three dimensional (3D) magnetic nanowires for ultra-high density information storage. Current memory architectures are 2D, composed of one layer of active components. The extension of data storage devices into the third dimension could result in information densities of hundreds of Gb/in2, causing a technological revolution. The project aims at implementing a 3D version of the existing 2D host institution's idea of domain wall based shift registers to store data. In this scheme, the data bits are stored using the two possible directions of the magnetisation in thin and narrow nanowires made of soft ferromagnetic materials. The fabrication of the 3D devices will be done by using a novel promising nanolithography technique: focused electron beam induced deposition (FEBID), with unique capabilities for the creation of 3D nanostructures. We have recently demonstrated the required possibility to control domain walls in cobalt nanowires created by this technique. The patterning of magnetic nanostructures by means of conventional lithography, such as electron beam lithography and ion milling, will be explored in parallel. The control of the domain walls will be probed by magneto-optical magnetometry and magneto-electrical measurements. The two directions to be investigated for the creation of 3D magnetic devices will be the stacking of 2D magnetic nanowires, and the direct fabrication of 3D nanowires. The host group possesses patents protecting the ideas presented in this proposal. The success of the project would place the European Union in a privileged position to lead the next steps in the development of Information Technology.

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**NBR: 251791** **ACRONYM: BIGNSPIN** **EC FUND: 45000**

**DG:** REA **Call: FP7-PEOPLE-2009-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Bismuth and Graphene Nanostructures for Spintronics

**Abstract:** This proposal addresses new scientific challenges in spintrontronics, with the focus on the miniaturization of magnetic sensors. Bismuth crystals and graphene layers show anomalously high Fermi wave length and mean free path. This allows us the observation of electron confinement effects in the length scale of nano-lithography techniques. Both systems can be grown and processed on Si-based substrates, which paves the way for the integration with the existing semiconducting technology. Quantum transport properties are to be studied twofold: by means of intense magnetic fields in nano-patterned devices, and by means of scanning tunnelling microscopy (STM) and spectroscopy (STS) at the surface level. In Bi epitaxial films and graphene flakes, Landau quantization grants access to the topology of the Fermi surface through magnetotransport measurements. The exceptional high-mobility of Bi and graphene gives rise to giant Hall and magnetoresistance effects (> 300,000 %), strongly influenced by structural parameters. Another consequence is the large spin-difussion length, which enables the transport of spin-polarized currents through large distances. Furthermore, the spin-split surface state of Bi crystals and graphene in contact with magnetic electrodes opens up the possibility of polarizing magnetically the medium and injecting spin-polarized currents. The purpose of STM studies here is to assess the influence of structural details at the atomic level on the macroscopic magnetotransport properties of Bi and graphene. STM in combination with pulsed field experiments will be used to investigate the loss of the 2-dimensional character of the electric transport as a function of the sample thickness. Both research lines are very appealing because of the enormous potential for practical device applications and the underlying Physics behind them.

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**NBR: 251813** **ACRONYM: NEMOLIGHT** **EC FUND: 138821**

**DG:** REA **Call: FP7-PEOPLE-2009-IOF** **Thema:** FP7-PEOPLE-2009-IOF

**Title:** Novel Experimental and Modelling approach for Optimisation of Light alloys

**Abstract:** We propose a novel multi-disciplinary approach for the optimisation of light alloys for structural applications in the objective of weight savings and reduction of greenhouse gas emissions for transportation applications. This approach will combine advanced experimental investigations in the fields of physical metallurgy and materials electrochemistry and the development of a mesoscopic modelling tool, and will be applied to precipitation-hardening Aluminium alloys. The development of nano-scale, multi-phase precipitate microstructures will be quantitatively characterised by advanced experimental techniques, including time-resolved synchrotron X-ray scattering, nuclear magnetic resonance, atom probe tomography and electron microscopy. It will be modelled by a physically-based approach, going well beyond the state-of-the-art by addressing the complexity of the sequence of metastable phases and of the competitive

formation of multiple phases in multi-constituent alloys. The project will be carried out first on a model Al-Cu-Sn alloy and then applied on industrial alloys. The project will be carried out in two institutions that are world leading in their respective fields of physical metallurgy and design of light alloys. It will involve active training of the main researcher on multi-disciplinary experimental research tools, on modelling of phase transformations in metals, and on research administration. The project will improve the excellence of the return host (Grenoble Institute of Technology) in the field of light alloy research, improve its international links and recognition, and will impact Europe's capabilities in the design and production of high performance light alloys. The project will improve the prospects of the main researcher to reach a prominent academic position in his field of research and teaching.

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**NBR: 251845** **ACRONYM: IBAHMA** **EC FUND: 117213**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** Ion Beam Applications to High-density Memory Archives

**Abstract:** Nowadays, safe archival data storage has become an urgent issue. The IBAHMA project concerns a new approach to providing ultra-stable (>50 years), ultra-high density (>1Tbit/sq.in.) data storage for archival applications, using ion-implantation to write nanoscale data into hydrogenated amorphous silicon carbide (a-SiC:H) films. Wide bandgap optical materials, such as a-SiC:H, when exposed to moderate ion doses develop useful optical contrast between regions of different irradiation levels. Absorption coefficient change of 1-2 orders of magnitude can be achieved by ion bombardment with chemically active species, like Ga+. The optical contrast formation mechanism is based on the ion beam induced structural and chemical modification of the implanted material, leading to considerable optical band-gap decrease and hence optical absorption increase. Furthermore, high-resolution digital (or analog) features of about 10 nm minimum size can be generated using focused ion beams (FIB), leading potentially to ultra-high storage densities. The use of Ga+ as an implanted species is of particular interest due to its widespread use in FIB systems and its relatively low melting point, which favours Ga incorporation as dispersed clusters or small nanoparticles in the host material. In this project, the precise nature of Ga incorporation into a-SiC:H films will be investigated, and the role of implantation conditions and post-implantation treatments on the achievable data density, readout contrast and data longevity will be investigated, and optimised conditions determined. In particular the precise role of temperature, both of the SiC 'target' during implantation and of post-implantation annealing treatments in determining the data storage characteristics (density, contrast, longevity) will be determined. The likely limitations for the practical application of this potentially very important new approach to data storage will also be assessed.

**NBR: 251862** **ACRONYM: NANOWIREDEVICESTM** **EC FUND: 179169**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** Combined structural and electronic characterization of semiconductor nanowire devices on the atomic scale using scanning tunneling microscopy and spectroscopy

**Abstract:** Free-standing III-V semiconductor nanowires, with diameters of about 20 to 80 nm at a length of several µm, offer tremendous possibilities for application in photovoltaics, optoelectronics, information technology as well as life-science. Semiconductor nanowire devices are not only smaller than conventional structures and significantly power-saving, but can even exhibit qualitatively novel behavior. Due to the small size and the very large surface to bulk ratio, the nanowire surface has a crucial influence on the performance of the entire device. Up to now, the conductivity and other electric properties of single nanowire devices on one hand and the nanowire crystal and surface structure on the other hand could only be measured separately. Here, we will combine both approaches in a novel experimental setup, enabling us to achieve information on the atomic surface structure and local electronic properties of an individual nanowire as well as the global electric behavior of a device built by the same nanowire simultaneously. For this purpose, we will study single, individually contacted semiconductor nanowires using scanning tunneling microscopy and spectroscopy (STM), obtaining data on e.g. the chemical composition and atomic reconstruction of the nanowire surface as well as the local density of states and local variations of the band alignment. During these STM measurements, external source, drain and gate voltages can be applied to the nanowire device, revealing the complex interaction of the nanowire surface, local charge distribution, and global device performance like conductivity and other transport properties.

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**NBR: 251887** **ACRONYM: CIDWM-NANOSTRIPS** **EC FUND: 166145**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** Current-induced domain wall motion in magnetic nanostrips

**Abstract:** The recent progress in the fabrication and direct synthesis of laterally confined structures, thanks to lithography techniques, has given rise to renewed interest in understanding the interaction between spin-polarized current and magnetic domain walls (DWs), because of it is a key technology for the future spintronics. Although there are several possible ways in which current can interact with magnetic domains, the most interesting interaction is that in which spin angular momentum transferred from the

spin-polarized current results in motion of the domain wall. The main aim of the present project is the study of CIDWM in nanostrips with different configurations of magnetic anisotropy. As a starting point, permalloy nanostrips with longitudinal anisotropy will be analyzed, where the composition will be varied in order to modify the STT. In a second stage, the project will be focused towards more original systems with perpendicular anisotropy. The research combines different activities: elaboration and nanofabrication of metallic nanostrips, study of the domain wall motion induced by spin-polarized current (this includes analysis of DW topology, depinning, velocity, mobility and position as a function of dimensions of nanostrips and current) using advanced magnetic imaging techniques, and advances in the micromagnetic modeling of the spin transfer torque. An important aspect of this project will be the effort for understanding inconsistencies and unresolved issues in the interaction of spin-polarized current with DW (existence and nature of non adiabatic contribution, thermal effects, maximum speed of DW driven by current and magnitude of current required to sustain the motion of DW along a nanostrip), whose answer will determine how useful CIDWM will be for technological applications. Therefore, the project pretends to include a good balance between fundamental, applied and theoretical research

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**NBR: 251897** **ACRONYM: CAENEUS** **EC FUND: 163622**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** Crenarchaeota ecology and nutrient utilization in the subsurface ocean (CAENEUS)

**Abstract:** Over the past 10 years, it become apparent that Crenarchaeota are not only striving in some extreme environments but that they are ubiquitously present in the aquatic and terrestrial environment including the oceanic water column. In the pelagic realm of the ocean, their relative contribution to the total prokaryotic abundance increases with depth. It has been shown that the mesophilic Marine Crenarchaeota Group I (MCGI) live chemoautotrophically, fixing carbon dioxide as carbon source and using ammonia as an energy source. Based on the abundance of the amoA gene, encoding the ammonia monoxygenase, a key enzyme common to all nitrifiers, it has been deduced that they might be more important nitrifiers than Bacteria. This has never been tested thus far, however. In this proposal, we will investigate the enigma of this MCGI cluster is utilizing ammonia in the deep ocean, where ammonia concentrations are below the detection limit using conventional analytical methods. We will determine the distribution of archaeal and bacterial amoA gene abundance throughout the water column down to abyssopelagic realms in the northern North Atlantic and the tropical Atlantic and distinguish between archaeal and bacterial nitrification and dark CO2 fixation rates. Using three different single-cell approaches in a correlative way, we will specifically focus on the potential shifts in the phylogenetic composition of the MCGI cluster and its autotrophic activity with depth, as ammonia concentrations are probably below the nanomolar level in bathypelagic waters. Taken together, we will determine for the first

time, the relative importance of archaeal vs. bacterial nitrification in the ocean. By focusing on two Atlantic sites with contrasting age of deep-water masses and accompanied to that, contrasting deep-water ammonia concentrations, we will be able to investigate the entire range of diversity and metabolic adaptation in Marine Crenarchaeota Group I.

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**NBR: 251930** **ACRONYM: ADAPTNANO** **EC FUND: 168969**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** Adaptive nanostructures prepared by hierarchical self-assembly

**Abstract:** The aim of the project is a rational design of complex molecular self-assembled surface nanostructures the properties of which could be externally switched or their self-assembly process could be externally controlled. The project covers the research on the self-organization processes of molecules on metallic surfaces with ultra thin insulating layers and graphene substrates. Using the intermolecular bonds with graded strength the complex hierarchical architectures should be realized. The incorporation of switchable molecules gives the structures specific functional properties. The main idea lies in the preparation of nanopores which can be opened or closed through switching the molecules by light induced cis/trans isomeration which will be controlled by a proper choice of the used light wavelength. The detailed study of intermolecular interactions on insulating layers as well as understanding the light-induced switching processes in the nanostructures will be in centre of interest. Next, the influence of adjustable electronic density of graphene substrates or external electric fields on molecular self-assembly processes will be also studied.

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**NBR: 252125** **ACRONYM: TCPBRCBDP** **EC FUND: 181970**

**DG:** REA **Call: FP7-PEOPLE-2009-IIF** **Thema:** FP7-PEOPLE-2009-IIF

**Title:** Tandem catalysis for the production of biofuel related chemicals from biomass derived polyols

**Abstract:** One promising strategy for the production of biofuels from cellulosic, hemicellulosic and lipid materials is to use polyols as a platform. Recent advances have led to direct and (potentially) large scale production of polyols such as ethylene glycol, glycerol and sorbitol. Nevertheless, the downstream production of valuable fuels from polyols is comparatively lacking. In this project we intend to bridge this gap by developing a new strategy that could directly convert polyols into valuable acetals. To achieve this, a one-pot multi-step process through tandem catalysis is envisaged. Acetals will be produced

through classical acetalisation reactions between polyols and aldehydes, with the latter being produced in situ from syngas by a tandem Fischer-Tropsch (F-T) reaction and hydroformylation reaction. An efficient, dual functional hybrid catalyst based on a nanoparticle core to which a homogeneous catalyst is tethered that is capable of both F-T and hydroformylation reaction will be designed and synthesized, which to our knowledge represents the first approach of tandem F-T/hydroformylation catalyst. In-situ spectroscopic techniques, such as IR and NMR, will also be applied to study mechanistic aspects of the reactions. The approaches described herein are of high novelty with respect to both biomass conversion and heterogeneous/homogenous catalysis potentially leading to be the more efficient use of renewable resources.

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**NBR: 252126** **ACRONYM: MAPNE** **EC FUND: 178374**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** Mechanobiology of Aplysia neurons

**Abstract:** Memory loss is a central symptom in different diseases such as Alzheimer's disease, and represents a significant social and economic burden for a large percentage of European citizens. Neuronal cell adhesion molecules belonging to the immunoglobulin superfamily (IgCAMs) are known to be involved in brain development processes, and also contribute to the synaptic alterations connected with memory formation in adults. The goal of this project is to elucidate the molecular, biophysical and cellular mechanisms of directed movements of neuronal growth cones, and in particular how, upon binding to the extracellular matrix or to other cells, IgCAMs control cytoskeletal dynamics and therefore synaptic plasticity. The central hypothesis of this proposal is that adhesion-mediated growth cone guidance involves a force transduced by the cytoskeleton upon IgCAM adhesion, and that this mechanical signal further stimulates Src protein tyrosine kinase activation. In order to test this hypothesis, state-of-the-art techniques will be combined in a highly interdisciplinary manner. This project lies at the interface between mechanics, cell biology, biophysics and surface physics. The proposer will use a well-established cellular model system for growth cone studies (Aplysia), state-of-the-art molecular tools (recombinant IgCAM and Src biosensor) and a high-resolution force measurement system (Atomic Force Microscopy, AFM) coupled with FRET imaging. By applying the first molecule-specific AFM measurements to live neuronal growth cones, the proposer will measure the forces transduced by IgCAMs to the growth cone cytoskeleton and at correlating them with Src activity in real time, thereby proving the force-dependence of neuronal connectivity. This proposal is related to many of the FP7 research objectives, such as "Nanosciences, Nanotechnologies, Materials and New Production Technologies" and "Health", specifically "Research on the Brain and Related Diseases, Human Development and Ageing"

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**NBR: 252179** **ACRONYM: HJSC** **EC FUND: 337093**

**DG:** REA **Call: FP7-PEOPLE-2009-IOF** **Thema:** FP7-PEOPLE-2009-IOF

**Title:** Hierarchical Junction Solar Cells: Theory guides Experiements

**Abstract:** Light harvesting and the conversion of solar energy into other usable forms of energy is currently one of the most challenging topics on the field of renewable energy. Different possible scenarios exist to achieve this goal, some are based on solar thermal power and others on a variety of pathways for artificial photosynthesis. Perhaps the most promising approach is based on direct conversion of solar energy into electric current using photovoltaic cells. Needless to say, any significant advancement in cheap, accessible, photovoltaic technology will have a tremendous impact on the world energy economy. The overall goal of this proposal is to develop enabling technology needed to realize breakthrough photo-conversion efficiencies for nanostructured thin film photovoltaic systems. We will meet this goal through fundamental physical understanding of the kinetic and photo-physical processes involved in the conversion of solar radiation into useful electrical current for these systems. Building on this understanding will enable the development of new nanoscale materials, device structures, and interconnection schemes that will transcend the limitations of current devices providing for efficiencies to support new classes of all-inorganic solar cell devices. At the heart of the present program is the collaborative experimental (Berkeley host) - theoretical (PI) scientific effort. We believe that the field of renewable energy calls for such a close, fruitful, and fertilizing program. It will generate new ideas, thoughts, and directions required for a major paradigm shift in these systems. Furthermore, it will open novel directions for fundamental and applicable research for years to come.

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**NBR: 252228** **ACRONYM: EXCITONIC SOLAR CELL** **EC FUND: 182970**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** Photovoltaic Excitonic Solar Cells

**Abstract:** Photovoltaic cells (PVCs) use semiconductors to convert light energy into electrical current and are regarded as one of the key technologies towards a sustainable energy supply. The current PVCs supplying power conversion efficiencies of 10–20%. However, their poor absorbing properties and the difficulty in producing uniform thin films over large area substrates make the manufacturing processes quite costly. Further, most current PVCs harvest solar energy with a wavelength below 1.1 micron, though almost 50% of the sun power reaching the earth is in the infrared (IR) regime, and the power conversion efficiency could be improved with the use of the IR portion above 1.1 micron. This paper proposes the development of radically new nanostructures and

molecular materials for the production of innovative solar cells, called excitonic solar cells (XSCs), competitive with traditional energy sources. The goals of the research are to develop XSCs using of semiconductor quantum dots (QDs) as light harvesting units, with a fine tuning of the optical cross section and of the band gap in the IR regime. To design molecular relays (MRs) that connect the QDs to electron conductor materials, the MRs should enable carriers' transport and good adhesion to the electron-transport nanostructures. Moreover, a specifically designed n-type semiconductors will be developed, such as ZnO or TiO2 nanofibers, with architecture, morphology and surface structure suitable to maximise the efficiency of the charge transfer processes at the QD. The competitive cost-efficiency ratios of the materials used in this research will be improved, developing efficient synthesis approaches and surface functionalization to enable reliable, large scale applications of XSC devices. The significance of this research is the integration of innovative materials in XSC devices to be used as environmentally clean, renewable electric power sources, paving the way for short-, medium-, and long-term applications.

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**NBR: 252231** **ACRONYM: EMOMFSSA** **EC FUND: 174240**

**DG:** REA **Call: FP7-PEOPLE-2009-IIF** **Thema:** FP7-PEOPLE-2009-IIF

**Title:** Extended metal-organic materials formed via subcomponent self-assembly

**Abstract:** This project aims to synthesise new metal-containing polymeric materials through self-assembly from simple building blocks. These self-assembled materials will be formed in water directly from diamine and dicarbonyl monomer units linked by imine bonds coordinated to copper(I) templates. The project is intrinsically multidisciplinary, building upon the techniques of organic synthesis and coordination chemistry to branch into applications in the fields of self-assembly and polymer chemistry. It spans the fields of organic and inorganic chemistry, bridging into materials science and nanotechnology. The project builds upon the experience of the applicant in metallo-supramolecular and materials chemistry to gain a deeper understanding of how subcomponent self-assembly may be used synthetically to generate complex and functional metal-organic materials. Then materials properties of the products including their electrical conductivity and light-harvesting properties will also be investigated. The materials produced will be dynamic-covalent polymers, capable of interchanging monomer units in solution. Despite their dynamic nature, the imine bonds between monomer units are not prone to rupture (C=N bond dissociation energy > 600 kJ mol-1), which could lead to strong polymer chains, and it has been demonstrated that coordination to copper(I) renders imines stable to hydrolysis even in aqueous solution. Although this project builds upon concepts developed in the fields of supramolecular and coordination polymers, the robust nature of the linkages between monomer units sets this project apart from these fields. The materials that will be prepared are predicted to be stiff and strong, and initial studies indicate that they could serve as electrically conductive

"molecular wires" and lead to applications as sensors, conductors, magnetic materials or light harvesting devices.

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**NBR: 252239** **ACRONYM: SINANOTUNE** **EC FUND: 148283**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** Dopant-surface interactions in silicon nanoclusters

**Abstract:** Silicon nanostructured films are promising materials for photovoltaic applications. By exploring confinement effects and changing the surface morphology, it is possible to vary the optical absorption threshold energy without the resource to different semiconductors. However, to exploit the potential of this class of materials, it is necessary to achieve a detailed understanding and control of n- and p-type doping. Here, a study of the interaction of dopant atoms with the surface of stand-alone silicon clusters is proposed. The investigation will be carried out using density functional theory electronic structure calculations, and observable properties will be applied to the interpretation of experimental results. The aim is to find the combination of dopant species, surface passivation and post-processing treatments that leads to optimum n- and p-type doping efficiency.

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**NBR: 252242** **ACRONYM: NANOTUNE** **EC FUND: 173240**

**DG:** REA **Call: FP7-PEOPLE-2009-IIF** **Thema:** FP7-PEOPLE-2009-IIF

**Title:** Sustainable routes to shaped nanoparticles for selective catalysis

**Abstract:** The IIF project NANOTUNE aims to design novel palladium nanoparticle-based catalysts with tuned particle properties, and use them to control the selectivity of catalytic reactions. Changes to the support and addition of second metals will be used to tune the electronic properties of the nanoparticles. In addition, the particle shape will be varied using templating species such as organic ligands or changing the porosity of the support. By a combination of these techniques, it will be possible to design a catalyst to give high catalytic selectivity. The catalysts will be tested in the direct synthesis of hydrogen peroxide from hydrogen and oxygen, and chemoselective hydrogenation of substrates relevant to the fine chemicals and pharmaceutical industries. The reactions were selected on the basis of their relevance to the sustainability and economic development of Europe. A high-level understanding of the shape and surface chemistry of the nanocatalysts will be achieved by using advanced characterisation methods, including solid state NMR, X-ray synchotron techniques, high resolution TEM and Diffuse Reflectance Infrared Fourier Transform Spectroscopy (DRIFTS). Work in these areas will

be in collaboration with the academic sector, both in the UK and Europe. The Fellow, Dr. Elena Cristina Corbos, is currently working in Japan, and will move to the UK and bring knowledge of the preparation of modified supports and DRIFTS catalyst analysis to the EU and to the host. The project has the potential to impact significantly on the future economic and sustainable development of the EU. Synthesis of catalysts with controlled properties is in line with the vision of the knowledge economy, which is a key part of the EU's future prosperity. Increased selectivity of catalytic reactions will improve sustainability, with fewer raw materials and energy required for the same yield of product.

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**NBR: 252296** **ACRONYM: PHOTORODS** **EC FUND: 229253**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** Photovoltaic cells based on nano-structured CdTe

**Abstract:** Cadmium Telluride (CdTe) is already established as a prominent conventional solar cell semiconductor material due to its energy gap 1.5 eV with an almost perfect match to the solar spectrum. The aim of this research is to study the use of nano-structured CdTe as the absorbing layer in PV solar cells, and to evaluate the performance and industrial potential of these cells for a spread of PV applications, from low cost to high efficiency thermo-sensitive platforms and devices. It would require an investigation of processes for inexpensive fabrication of large periodic arrays of semiconductor nanostructures that will allow for (a) controlled variations in the size and composition of the nanostructures, (b) encapsulation of the semiconductor nanostructures in a rugged host material, (c) flexibility to use a variety of substrate materials, and (d) compatibility with standard silicon fabrication techniques. Additionally, the same CdTe-based PV nano-structures could be used as efficient imaging flat-panel direct-conversion semiconductor detectors for applications in such diverse fields as nuclear medicine, homeland security, astrophysics, and environmental remediation.

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**NBR: 252355** **ACRONYM: HALOGENILS** **EC FUND: 153864**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** New Halogenated Ionic Liquids as novel task-specific fluids

**Abstract:** Organohalogen compounds are key materials in chemical, medicinal, agrochemical, and material sciences. They can also be used as basis for alternative reaction or extraction schemes due to their poor miscibility with both hydrocarbons and water. Hence, it is of great importance to develop environmentally benign selective halogenated systems.

One of the key-issues concerning the current importance of ionic liquids is the fact that they can simultaneously act as sophisticated solvation or reaction media while avoiding dramatic impacts in the environment due to their general negligible volatility and non-flammability. Their ability to dissolve a wide range of compounds and their ionic nature provides new ways to carry out chemical reactions or industrial separations with enhanced yields. Following these trends it is of great importance to develop neoteric ionic liquids with halogenated alkyl chains that can boost their application into new research areas. Two main objectives are pursued on this project. On one hand these news ionic liquids can induce a breakthrough on ionic liquids research by the formation of three nanosegregated domains (polar, apolar and halogenated) with improved extraction properties. Understanding at a molecular level their nature and interactions can drive this research project a step forward into the industrial application of these compounds. On the other hand, the introduction of halogenated atoms on specific positions of the resonance ring of the imidazolium cation of an ionic liquid can induce lower viscosity, lower melting point, lower enthalpies of vaporization and higher vapor pressures compared to the already available ionic liquids. Fulfilling this objective eases the determination of energetic properties of ionic liquids, with more precise results that can be used to validate the simulation models developed and contribute to the implementation of more reliable predictive tools.

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**NBR: 252407** **ACRONYM: NANOALLOY** **EC FUND: 158600**

**DG:** REA **Call: FP7-PEOPLE-2009-IIF** **Thema:** FP7-PEOPLE-2009-IIF

**Title:** Induced electrodeposition of nanostructures as nanowires and nanotubes consisting of cobalt-based multilayers for MEMS applications

**Abstract:** Purpose of the project: This project is focused on the synthesis by induced electrodeposition of nanowires and nanotubes as multilayered structures consisting of cobalt alloys with refractory metals like Mo and W. Hereto the superfilling of nanopores present as arrays in anodized aluminium oxide (AAO), will be investigated in-depth. First proofs of principles have been recently achieved by the applicant. The background of the host institution on electrodeposition in micro-pores (e.g. vias used in microelectronics) and its modeling is a most important support to this project. Objectives of research: - To develop at the host institution the scientific insight required for the lab demonstration of the technological feasibility of the novel concept of producing nanostructures (nanotubes, nanopores) with different aspect ratios in AAO by a low cost electrodeposition from environmental-friendly aqueous electrolytes, - To transfer the scientific knowledge to a third country with the objective of nurturing present collaboration and to explore the possibility of further collaboration between researchers and industry inside and outside EU, - To train an experience researcher from a developing country by a European specialist on electrodeposition and tribological testing. Expected research results: - The electrodeposition of cobalt-based

homogeneous and multilayered nanotubes and nanowires engulfed in anodized aluminium, and as free-standing products after release from anodized aluminium. - Scientific insight on the role of electrochemical parameters on structural and functional properties of electrodeposited nanotubes and nanowires either engulfed or released from anodized aluminium. - Mapping of the functionality of nanotubes and nanowires made of compositionally modulated layers in view of future applications in MEMs and NEMs technology as wear resistant and/or electro-magnetic materials. .

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**NBR: 252477** **ACRONYM: NUSIRALS** **EC FUND: 121241**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** Novel Ultra-Sensitive Infra-Red Absorption Laser Sensors

**Abstract:** In-line and in-situ fast ultra-sensitive detection of gaseous species at part per billion and part per trillion with ability to distinguish isotopomers without any pre-processing of gas sample is of high interest in chemistry, medicine, geology, physics, various other sciences and industries. Recent technology achievements in development of compact and robust tunable near-infrared and mid-infrared lasers open a door to new applications of optical sensors based upon laser absorption spectrometry. Nowadays, in-situ portable laser sensors based upon direct absorption detection with a mid-infrared quantum cascade laser or a near-infrared diode laser and large volume long path length multi-pass optical cell can compete in accurate isotope-ratio measurements even with ion-mass spectrometers. But in order to reach new horizons significant improvement in sensitivity is necessary. The aim of the project is to develop novel approach of ultra-sensitive gas sensor based upon laser absorption spectrometry and demonstrate absorption sensitivities limited by a shot noise which is caused by the fluctuations of detected photons. The technology based upon frequency modulation of laser, optical locking of the laser to high finesse optical cavity formed by high reflectivity mirrors and signal detection at frequency of free spectral range of the cavity will be developed and tested. We expect to demonstrate highest absorption sensitivities. Laser sensors based upon this technique and mid-infrared and near-infrared lasers will be able to measure molecule concentrations at levels of part per trillion per volume. Robustness and ultra-sensitivity of the developed sensors, knowledge and technology transfer within the project will contribute to widespread implementation of laser sensors in on-line monitoring of impurities in nanotechnology and chemistry, measurements of isotopomers in medicine, geo-science and environmental research, others industrial and social applications.

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**NBR: 252520** **ACRONYM: HIGHTEMPPROP** **EC FUND: 130430**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** High Temperature Nanoindentation and Micropillar Compression as Methods for Studying the Deformation Behaviour of Hard Coatings

**Abstract:** The aim of this project is to explore the use of high temperature nanoindentation and micropillar compression as methods for studying the deformation behaviour of hard coatings. The development of methods for material testing at high temperature is particularly important in hard coatings as the drive for dry machining at ever greater rates increases the service temperatures of materials whose flow stresses are both rate and temperature dependent. The fellowship will allow a scientist from one of the world-leading groups in the field of advanced hard coatings based at Montanuniversität Leoben, Austria, to cooperate with a group in the University of Cambridge, where both techniques have been used to study the deformation behaviour of brittle materials over a range of temperatures and which was the first to demonstrate the possibility of micropillar compression at elevated temperature.

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**NBR: 252534** **ACRONYM: COMET** **EC FUND: 244498**

**DG:** REA **Call: FP7-PEOPLE-2009-IOF** **Thema:** FP7-PEOPLE-2009-IOF

**Title:** Conducting organic materials for tissue engineering and drug delivery.

**Abstract:** Tissue engineering aims to facilitate the re-growth of damaged or diseased tissues through the design of three-dimensional scaffolds and has implications for society in terms of treating spinal cord injuries and degenerative brain diseases. The overall objective of this research programme is to design, synthesize and develop new conducting and biodegradable scaffold materials with the capacity to deliver drugs or growth factors for applications in tissue engineering. To achieve this, three approaches are being considered. The first is the formation of nanoparticles and/or nanofibers of polypyrrole (PPy) with existing biodegradable polymers to form composites. Secondly, conducting polymer materials with both conducting and non-conducting segments will be developed. And finally, this objective will be examined using a natural polymeric material, melanin. These approaches will be achieved through a number of chemical and electrochemical techniques including electrospinning, electropolymerization and chemical vapour polymerization, as well as, organic synthesis and spin coating. These materials will also be studied in terms of their biodegradation rates, biocompatibility and their ability to promote cell attachment, cell proliferation and to stimulate nerve cell regeneration. In achieving this objective Dr. Hendy will develop new experimental skills, gain expertise in the synthesis of advanced polymeric materials for controlled drug delivery and tissue engineering and gain expertise in all aspects of a researcher's role. In this area of biomaterials, MIT is the most prestigious University in the world, allowing Dr. Hendy to become exposed to new equipment, which in turn will help develop a host

of new complementary skills; consequently this training, will have a key impact on both Ireland and Europe upon Dr. Hendy's return.

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**NBR: 252542** **ACRONYM: FLAGELLA** **EC FUND: 181726**

**DG:** REA **Call: FP7-PEOPLE-2009-IOF** **Thema:** FP7-PEOPLE-2009-IOF

**Title:** Fluid Mechanics of Flagellar Propulsion

**Abstract:** The locomotion of microorganisms in fluids is a theme of major importance in biology. It affects many processes such as mammalian reproduction, the marine life ecosystem, and the dynamics of bacterial infection. Locomotion is typically achieved by the periodic deformation of flagella (short and flexible organelles) that drive the fluid motion around the microorganisms, and generate propulsive forces. The shape of the flagella is, in turn, affected by the fluid dynamics forces generated by the organisms. The understanding of this complex fluid-structure interaction calls for a multidisciplinary approach, at the intersection of physics, mechanics, biology and applied mathematics. The present research and training project will be dedicated to some open fundamental issues of flagellar propulsion. One key point of its methodology is the combined experimental and theoretical approach. A macroscopic experiment will be built with the aim of mimicking the motion of a bacterial flagellum. By immersing a rotating flexible filament in a highly viscous fluid, the fluid mechanics is identical to what occurs at the microorganism scale but with the advantages of a perfectly controllable experiment. Several important phenomena will be studied independently such as the motion in a viscoelastic fluid, the interaction of several flagella, the mixing properties of the fluid dynamics, and the effect of intrinsic curvature on the propulsion efficiency. In parallel, theoretical models will be developed with the aim of providing deeper insight into the physical mechanisms by extending the regimes of the actual models (resistive force, and slender-body models). This proposal is related to important Health issues such as bacterial infection, sperm motility and the design of micro-robots able to perform minimally invasive surgery and targeted drug delivery. This project will therefore contribute to European competitiveness on two major themes of the FP7 Programme: Health and Nanosciences.

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**NBR: 252581** **ACRONYM: NANOPERMAG** **EC FUND: 202318**

**DG:** REA **Call: FP7-PEOPLE-2009-IIF** **Thema:** FP7-PEOPLE-2009-IIF

**Title:** HIGH PERFORMANCE NANOSTRUCTURE PERMANENT MAGNETS

**Abstract:** The development of a new generation of permanent magnets is more urgent than ever in view of the demand for more efficient engines in wind energy, all electric cars and

space applications. The purpose of this proposal is to exploit the opportunities available to fabricate powders of magnetically hard rare earth intermetallic nanoparticles/nanograins to develop new classes of anisotropic nanocomposite magnets with previously unattainable high energy products, (BH)max . We will use both 'top-down' and 'bottom-up' approaches to develop these materials. This program will be directed towards the synthesis and investigation of magnetically hard powders consisting of anisotropic Sm-Co, Sm-Fe-N and Nd-Fe-B nanoparticles with sizes below 300 nm, and soft powders based on Fe(Co) nanoparticles with sizes in the range of 10-20 nm and with properties close to those of the bulk. We shall use a variety of different fabrication techniques including chemical and mechano-chemical synthesis, surfactant assisted milling, and cluster gun deposition. Research will be focused on the 2:14:1/Fe(Co), 1:5/Fe(Co), 2:17/Fe(Co) and Sm2Fe17Nx/Fe(Co) nanocomposite systems. Micromagnetic calculations will be used to model different architectures for the optimum performance using parameters including particle size and shape, the geometrical arrangement of the hard and soft nanoparticles, and hard/soft structures with core/shell morphology. These modelled nanostructures will be fabricated for comparison with theoretical predictions and further optimisation. The emphasis will shift towards the blending, alignment and consolidation of the hard/soft powder architectures to obtain the next generation bulk permanent magnets with a twofold increase of the (BH)max at room temperature i.e. up to 800 KJ/m3. To achieve this objective we have assembled an experienced multidisciplinary team of physicists, chemists, materials scientists, and engineers to develop these next generation magnets.

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**NBR: 252586** **ACRONYM: ELEPHANT** **EC FUND: 181103**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** First-principles modelling of electron-phonon anisotropy (ELE-PH-ANT) in low-dimensional superconductors

**Abstract:** Superconductors' remarkable ability to carry significant currents and generate strong magnetic fields is finding use in numerous applications, including energy storage and distribution, medicine, electronics, and transportation. The ground-breaking discoveries of superconductivity in magnesium diboride and iron pnictides have triggered a new wave of fundamental and applied research. In this context, the development of innovative computational methods is an important research direction that will give further insights into the physics of superconductivity and may allow the design of new materials with tailored superconducting properties. I will investigate the role of spatial anisotropy in appealing phonon-mediated superconducting materials by developing and applying cutting-edge atomistic simulation methods. My main goal is to integrate a recently proposed methodology for the electron-phonon interaction based on Wannier functions with the anisotropic Migdal-Eliashberg formalism. The approach holds great promise for qualitatively better description of low-dimensional superconductors, in

which the anisotropy of the electron-phonon interaction plays a crucial role, and for enabling the investigation of complex systems, which are beyond the reach of present computational methods. The application part will be devoted to exploring the superconducting mechanisms in carbon- and boron-based materials of reduced dimensionality. Graphite intercalation compounds are still a subject of debate due to the anisotropic nature of the electron paring while carbon nanotubes pose a largely unexplored fundamental question of how superconductivity can emerge in one-dimensional systems. Finally, magnesium diboride remains to be the most outstanding phonon-mediated superconductor despite an extensive search for related superconducting materials: a systematic screening will be carried out to identify multi-component metal boride materials with potential for superconductivity.

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**NBR: 252608** **ACRONYM: QM** **EC FUND: 172565**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** Quantum Measurements and Ground State Cooling of Mechanical Oscillators

**Abstract:** Cavity optomechanics has over the past years emerged as a new research field in which basic concepts of quantum measurement theory such as quantum limited displacement sensing or backaction evading measurements as well as highly sensitive force measurements may be realized by virtue of radiation pressure optomechanical coupling to nano- and micro-mechanical oscillators. The objective of this research area is to achieve quantum limited detection of mechanical motion and ground state cooling of a mechanical oscillator. Analogous to the success of quantum limited photon detectors in the field of quantum optics, it is likely that quantum limited motion transducers will continue to lead to new advances in both fundamental science and technology. The significance of the research program lies in experimentally approaching the fundamental quantum limits of motion transduction and demonstrating quantum phenomena of a mechanical oscillator; the most tangible harmonic oscillator. This research will directly build on the recognized contributions of the participating Swiss research group, which is the Laboratoy of Photonics and Quantum Measurements of Dr. Tobias J. Kippenberg at the EPFL. The research group has over the past 4 years made many seminal and widely recognized contributions to the field of cavity optomechanics. The applicant is a French scientists who obtained his PhD at ENS in Paris in the labatory of the world renowned Quantum Physics pioneer Serge Haroche. His work has been pioneering and has been published in leading journals (including two publications in Nature). The proposed research activities are at the forefront of the rapidly developing field of cavity optomechanics - which has sparked widespread contemporary interest in Physics - , and will place the applicant in an excellent position to launch into a carreer in science. Moreover the applicant will be exposed within the Laboratory of Photonics and Quantum Measurements to complementary research projects.

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**NBR: 252701** **ACRONYM: TRANSFECTDNA** **EC FUND: 250273**

**DG:** REA **Call: FP7-PEOPLE-2009-IOF** **Thema:** FP7-PEOPLE-2009-IOF

**Title:** â€œSURFACE FUNCTIONALISEDâ€• CATIONIC LIPOSOME-DNA COMPLEXES CONTAINING PEPTIDE-LIPIDS WITH POLY(ETHYLENE GLYCOL) SPACERS: STRUCTURE, TRANSFECTION EFFICIENCY AND INTERACTIONS WITH THE CYTOSKELETON

**Abstract:** Cationic lipids (CL) are the most promising candidates for efficient and safe gene-delivery vectors for gene therapy. Compared with viral capsids, CLs do not induce a response from the immune system. Moreover, while viral capsids have a maximum DNA-carrying capacity of about 40 kbp, CLs, which form self-assemblies with distinct lamellar LαC and inverted hexagonal HIIC, or HIC nanostructures when complexed with DNA, place no limit on the size of the DNA. Despite all these promises, transfection efficiency (TE; a measure of the expression of an exogenous gene that is transferred into cells) remains low, and only a substantial increase in the knowledge of relative interactions between CLs, DNA and cell's components can lead to the design of optimal CL-DNA complexes for gene therapy. Here we propose to design and study novel surface-functionalised PEG-CL-DNA complexes with a RGD and SV 40 peptide sequences. The use of PEG is required to avoid opsin complexation (hence, removal from the organism), while the RGD sequence is expected to induce endocytosis, allowing entrance of the complexes into cells. The SV 40 (a nuclear localisation sequence – NLS) is expected to lead to transport of the smaller sized complexes into the nucleus, permitting the usage of CLs as vectors in slowly or non-dividing cells. To test these hypotheses, transfection studies and confocal microscopy will be carried out in cells, whereas the structures and interactions of the complexes will be characterised with synchrotron x-ray diffraction. The interactions between CLs, DNA and cell components (mainly cytoskeleton filaments and cytoskeletal proteins) will be studied in-vitro with synchrotron x-ray diffraction, confocal microscopy and cryo-transmission electron microscopy. The whole of these studies will permit the rationalisation of the crucial parameters affecting TE, based on the structures of CL-DNA complexes and their interactions with the cytoskeleton.

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**NBR: 252711** **ACRONYM: ENGINEERED OXIDES** **EC FUND: 172740**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** Design of New Engineered Oxide Thin Films with Tailored Properties

**Abstract:** Development of new energy conversion technologies are a prime concern for the EU. To achieve low emissions and high efficiencies new materials advances are required. Research on new oxide materials with both high ionic and electronic conductivity (MIEC: mixed ionic and electronic conductors) is of key importance in order to achieve optimum performance in electrochemical energy conversion devices such as solid oxide fuel cells, gas sensors, oxygen membrane generators and catalytic oxidation systems. Particularly, in these applications there is a major interest in reducing the working temperatures to about 600 °C. Control over the electronic and ionic conductivity of the MIEC material, as well as the oxygen surface exchange kinetics is therefore a crucial issue. We propose to study several very promising MIEC ceramic materials, from both the Ruddlesden-Popper Ln2NiO4+x (Ln = Nd, Sm, Pr) family and the layered cobaltite (GdBaCo2O5+x) family. Both families of compounds have anisotropic ionic and electronic transport properties, and therefore in order to extract information about their intrinsic anisotropic properties, single crystals and epitaxial thin films will be measured. In addition we will study new engineered layered oxide thin films materials with different heterointerfaces, which very recently have attracted increasing interest due to some outstanding results which include high ionic conductivity and oxygen exchange enhancement. Once these studies have been performed we will try to design new engineered thin films by using perovskite layers and rock-salt type layers as building blocks to control nanostructures with optimized tailored properties. In addition, the study of the variation of these properties for films submitted to different stress will enable innovation that will be of interest in designing new MIEC materials with enhanced performance for different types of advanced electrochemical devices, of great importance in the changing energy economy.

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**NBR: 252714** **ACRONYM: EMOL** **EC FUND: 233089**

**DG:** REA **Call: FP7-PEOPLE-2009-IIF** **Thema:** FP7-PEOPLE-2009-IIF

**Title:** Investigation of low-energy electron collisions with molecules in cluster and surface environments

**Abstract:** In the past decade, it has become increasingly apparent that low-energy electrons (LEE) play a critical role in a large number of fundamental and applied fields. Electrons with energies in the range 0-10 eV can induce specific chemical reactions which are relevant to nanolithography, dielectric aging, radiation waste management, radiation processing, astrochemistry, planetary and atmospheric chemistry, surface photochemistry, radiobiology, and radiotherapy. In the last decade researchers in the European Union have been at the forefront of such research and, through a number of EU supported networking activities (co-ordinated by the host), have led the international research community in the development of experimental studies of LEE interactions with molecules in the gaseous phase and at the surface of molecular and biomolecular solids pioneering a new field of 'electron induced chemistry'. However, a comprehensive

theory capable of predicting the dissociation dynamics of such electron molecule interactions - the precursor to the subsequent electron driven chemistry – has remained elusive. The applicant, Professor Ilya Fabrikant, has been at the forefront of such theoretical studies for more than 30 years. The purpose of the proposed IIF is to allow Professor Fabrikant to transfer his expertise to the emerging younger theoretical research community within the European Union. Based at the host institution, chosen because of its unique combination of experiment and theoretical research and recognised leadership in the field of electron induced chemistry, Professor Fabrikant will pursue a novel research program investigating electron attachment, and particularly dissociative electron attachment (DEA) with polyatomic molecules across a range of media including gaseous, clusters, surface and bulk matter, exploring how this basic chemical precursor process is influenced by such different environments.

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**NBR: 252743** **ACRONYM: JBGIM** **EC FUND: 173240**

**DG:** REA **Call: FP7-PEOPLE-2009-IIF** **Thema:** FP7-PEOPLE-2009-IIF

**Title:** Functional Nanoscale Coordination Polymers: Controlled Growth by Metal-Containing Block Copolymer Templated Self-Assembly

**Abstract:** Coordination polymers are infinite arrays of bridging ligands bound to two or more transition metal ions. The potential application of coordination polymers in the areas of materials and nanoscience is significant as their properties can be tuned through variation of the transition metal ions and bridging ligands. To date, research in the area of functional nanoscale coordination polymers has been limited to amorphous (spherical) and crystalline (non-spherical) examples and the controlled growth of coordination polymers has not been realized. We propose the use of metal-containing diblock copolymer templates, which self-assemble in a number of different morphologies depending on the volume fraction of the blocks, to influence the structure of coordination polymers on the nanoscale, and for the first time demonstrate control over their size and shape. Our approaches will afford multifunctional materials with highly tunable properties, and the incorporation of diblock copolymers will allow for the rational design and controlled growth of nanoscale coordination polymers. This highly interdisciplinary and multidisciplinary research proposal requires a wide range of skills and this is exactly the mix possessed by the applicant (ligand design, coordination chemistry, stable-radical chemistry, electrochemistry, and molecule-based magnetism) and the host laboratory (polymer chemistry, materials chemistry, and nanoscience). The proposed research will bring a promising young researcher to Europe, and will lead to a new area of functional polymer and materials research where a range of potential applications are envisioned.

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**NBR: 252757** **ACRONYM: NANOCON** **EC FUND: 166145**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** Nanocontacted Thin Molecular Films for Spintronics

**Abstract:** This proposal is placed in the area of molecular spintronics, a multidisciplinary area of knowledge in between molecular magnetism, molecular electronics and surface science and deals with the integration of molecular materials in spintronic devices. The weak spin–orbit coupling and hyperfine interactions found in organic materials, along with its ease of processability and tunability, make molecules became serious candidates to substitute traditional metals and inorganic semiconductors or insulators in spintronics devices. This offers the possibility of constructing devices were spin–coherence will be maintained over times hardly conceivable only some years ago. Additionally the use of magnetic molecules in spintronics devices is the expected evolution to shift from molecular electronics area to molecular spintronics field. Through the deposition over surfaces of thin films, their integration into organic molecular tunnel juntions (OMTJs) and the study of the molecule-surface interfaces this project combines chemistry, surface science and spin-transport physics. This proposal will try to go beyond the current state-of-the-art in the field of molecular spintronics by using molecular materials as spin barriers in OTMJs and its ultimate goal is to perform magnetotransport measurements through conveniently nanostructured thin organic layers and molecular materials. Special attention will be paid to the molecule-surface interface, critical to correctly interpret transport measurements. It is divided in two main parts, the first one deals with the use of thin organic barriers, self-assembled monolayer or polymeric thin films, in the preparation of OMTJs (1. THIN FILM MOLECULAR SPINTRONICS) and the second one intend to measure transport properties of a single molecule magnet (SMM) spintronic device. (2. SINGLE-MOLECULE SPINTRONICS). In the nanodevice robust SMM of the Mn4 and polyoxometalate will be separated from the electrode by an organic spacer. During the development

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**NBR: 252781** **ACRONYM: CHICROCSX** **EC FUND: 166645**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** Core-Hole Induced Chemical Reactivity of Complex Systems by Soft X-Ray Spectrosocopies

**Abstract:** The present proposal concerns a new research direction which is the study of the core-hole induced chemical reactivity of complex systems. It is based on the use of the most advanced instrumentation available nowadays for soft X-ray spectroscopy: the ultra high resolution soft X-ray beamline PLEIADES at one of the most recent synchrotron radiation

facilities in Europe – Synchrotron SOLEIL, together with state-of-the-art electron and electron-ion coincidence spectrometers. The host group offers a highly dynamic scientific environment based on a long-term outstanding experience with inner-shell spectroscopies of diluted species. The association with this environment, the excellence and the strong background in chemistry of the researcher, will definitely ensure the success of the proposed project. The main research objectives of the proposal include studies of ultrafast processes like intra- and intermolecular nuclear rearrangements, chemical reactivity of nanoparticles, construction of a new temperature controlled reaction chamber and the study of thermodynamics with advanced physical spectroscopic methods. The new opportunities provided at the starting beamline PLEIADES will allow the researcher to develop her own research line including dynamics and reactivity of systems of biological and environmental interest and to address the famous homochirality of life problem. The proposed project will allow the researcher to develop her scientific personality, acquire new competences and pursue her own research lines, along the above-mentioned directions. Her perspectives for future employment as a scientist in this field of research will be much improved, and her experience will allow to contribute to the advancement of science in any of the European countries where extreme light sources like synchrotron radiation or free electron lasers are used tools, or even contributing to their development where they represent an emerging tool (ELI source for instance).

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**NBR: 252858** **ACRONYM: NANOMEGA** **EC FUND: 204568**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** Novel approach to toxicity testing of nanoparticles mimicing lung exposure. Possible protective effect of omega-3 acids

**Abstract:** As nanotechnology and materials science have progressed, large quantities of engineered nanoparticles (NPs) have been produced. NPs promise to revolutionize our lifestyles by improving many industrial and consumer products. However, there is considerable concern about their unknown impact on human health: with their unique physicochemical properties (size less than 100 nm), NPs differ from the corresponding bulk material. Here we address the urgent need to determine the potential effects of NPs on human health and environmental safety. Our objectives are: a) To develop and optimize a novel approach to in vitro NP testing using an epithelial cell culture model that mimics in vivo interactions of particles with cells; b) To study mechanisms of NP toxicity using cardiovascular/cardiopulmonary cell models to identify specific markers of oxidative stress and their role in activating signal pathways associated with the inflammatory response, DNA damage and repair; c) To investigate protection by omega-3 fatty acids against inflammatory effects of NPs, and possible modulation of DNA repair, in an in vitro model. This research will provide information on mechanisms of action of metal oxide NPs, and specifically on their effect on risk of

cardiovascular/cardiopulmonary diseases. The results will contribute to protecting European public health, and will be crucially important for formulating policy on safety of nanotechnology. The ambitious research tasks provide an excellent opportunity for the career development of Dr. Rinna in this new field. By developing innovative techniques mimicking in vivo conditions, carrying out experiments on potential NP toxicity, and investigating how cells and DNA can be protected against injury, she will acquire an impressive range of expertise. By supervising master and co-supervising PhD students, she will improve her management and teaching skills and thus establish a base for a longer term position as a research team leader in Norway

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**NBR: 252883** **ACRONYM: SFL-PRR** **EC FUND: 172740**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** New Switchable Organometallic Oligomers and Polymers

**Abstract:** Silicon-based microelectronics will soon reach their limit of miniaturization when feature lengths shrink below 70 nm. The next generation of electronic devices require materials that remain functional on a nanometre scale. Molecule-based integrated circuits will operate on a scale several orders of magnitude smaller than silicon-based electronics allow. The search for molecular components suitable for such applications is one of the fundamental tasks of modern science. We will develop a new class of hybrid polymer materials that will provide key components for molecular-based electronics. These new materials contain both early and late transition metal centres linked by modulating organic groups so that electrons can flow along the polymer chains. By altering the metal oxidation state or conformation of the organic groups it will be possible to switch “on” or “off” the electron flow and the materials will act as “molecular switches”. The switch will be activated by chemical means or by light irradiation or applying pressure. These new design features make these materials much more versatile than existing molecular components and would put European research at the forefront. The project involves the development of novel synthetic strategies for the new materials and the investigation of their electronic properties using cutting-edge time-resolved spectroscopic and diffraction techniques that will provide unique information on the structures of short-lived species. The project is multidisciplinary including aspects of chemistry, physics and materials science. Apart from the research objectives, this proposal will help the applicant to reach a position of professional maturity by gaining experience of organometallic polymers and in pioneering time resolved crystallographic techniques. The applicant will also develop her experience in teaching, oral and written communication and networking by interaction with leading mentors at a top rank institution.

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**NBR: 252906** **ACRONYM: HY-SUNLIGHT** **EC FUND: 222272**

**DG:** REA **Call: FP7-PEOPLE-2009-IIF** **Thema:** FP7-PEOPLE-2009-IIF

**Title:** Optical properties of hybrid organic/inorganic nano-particles for photovoltaic applications: toward a predictive computational approach

**Abstract:** Hopes for a new generation of photovoltaic technology (PV) which may overcome the limitations of the present semiconductor-based technology are based on organic materials, due to their light weight and broad absorption spectrum. In this respect, a special role is played by hybrid organic/inorganic nano-particles. Typical hybrid PV (HPVs) are composite films of semiconductor nano-particles (quantum dots) coupled to organic cromophores active in the visible range. Despite the strong efforts to improve efficiency and stability of HPVs to outperform standard inorganic cells, at present no theoretical/computational approach, going beyond heuristic models, is available to reliably describe the optical excitation of HPVs. These complex systems are untractable by present computational tools due to the very different nature of light-matter interactions in the different segments, leading the respective optical excitations to cover very different length scales. This situation is particularly unsatisfactory as the optical properties of hybrid organic/inorganic nano-particles may find ground-breaking applications in other applied field, notably nano-medicine and biology. The goal of the present proposal is to build the theoretical/computational background for a quantitative modeling of the light response of HPV. The specific objectives are i) a methodological advancement in HPV description, namely, the development of a genuine multi-scale computational method, based on a 'hybrid' Configuration Interaction approach, suited to deal with nano-hybrid systems; the new method should be able to describe excitations unique to, and delocalized over, the hybrid system in a nearly parameter-free approach, comparable to standard quantum-chemistry approaches which would not be applicable in this case; ii) the application of the new scheme to selected proto-typical systems of interest for HPV, and the conceptualization of the microscopic mechanisms of their optical properties.

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**NBR: 252926** **ACRONYM: SALINAME** **EC FUND: 173065**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** Self-assembly of magnetic core-shell nanoparticles at liquid-liquid interfaces for the fabrication of ultra-thin responsive membranes

**Abstract:** The goal of this project is to study and control the self-assembly of superparamagnetic iron oxide nanoparticles (NPs) stabilized by a shell of responsive polymers at liquid-liquid interfaces in order to crosslink them into ultra-thin, mechanically stable, responsive

membranes. This novel “smart” material will have unique properties suitable for applications in miniaturized lab-on-chip and other microfluidics devices. The interdisciplinary nature of the project contributes to its scientific novelty and impact, and constitutes an extraordinary training experience for the applicant. In the first part of the project, the applicant will develop a novel combination of experimental techniques to characterize the fundamental aspects of core-shell NP adsorption at liquid-liquid interfaces. By means of advanced confocal microscopy and particle tracking, complemented by pendant-drop tensiometry, this project will yield an exhaustive characterization, both from a microscopic and macroscopic point of view, of such system, so far practically unexplored. The obtained understanding - of high scientific relevance in its own right - will be used to optimize the design and fabrication of crosslinked responsive NP monolayer membranes. Using superparamagnetic NPs stabilized by a shell of crosslinkable thermoresponsive polymers, the applicant will produce ultra-thin robust assemblies which can respond reversibly to external stimuli. Temperature changes and consequent responses can be imparted to the system locally by exploiting the magnetic functionality of the NP constituents (heat transfer in an AC magnetic field). Moreover the crosslinked membranes can be actuated in DC magnetic fields as envisaged for applications. The responsive properties of the resulting materials, which have no current equivalent, will be investigated by means of optical and atomic force microscopy (structural properties) and microrheology and colloid-AFM force spectroscopy (mechanical properties).

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**NBR: 252935** **ACRONYM: ASSAY FOR BIOMARKERS** **EC FUND: 177374**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** Magnetic Nanoparticles for Multiplexed Assays for Low and High Molecular Weight Biomarkers

**Abstract:** The application for the FP7-PEOPLE-2009-IEF is to support a move of a postdoctoral researcher to University College Dublin, UCD. The researcher to date has published in 16 peer reviewed journals and has a current h-index of 8. With the expert training and opportunities in place at UCD, the award of the fellowship will build upon the successful start of his academic career and deliver him to a full time academic position. This research proposal outlines a new technique capable of screening biomarkers with the capability of working directly in biological samples. The benefits of monitoring biomarkers lie in their ability to reveal signs of disease before the onset of major symptoms. The proposed technique will involve synthesizing nanoparticles to contain paramagnetic and optical properties, that will then be functionalized with aptamers/ or antibodies. These functionalized particles will capture the biomarkers directly from solution, and in conjunction with non-linear magnetophoretic separation, NLM, will allow the quick separation and detection by exploiting the particles superparamagnetic and optical properties, creating a new diagnostic technology. The experimental details

will deliver a single process capable of capturing the analyte as well as performing the initial sample purification and pre-concentration stage that screens multiple biomarkers for several diseases across a wide range of molecular weights and functionalities. It will deliver benefits of being both a multiplexed technique that also offers a highly desirable tagless detection mechanism. The training that accompanies this will ensure the fellow has a broad scientific understanding, crossing several scientific fields delivering an interdisciplinary research approach. When combined with the support infrastructure in place at UCD, will deliver outstanding career enhancement prospects to the applicant, delivering a new diagnostic technique to enhance the European research portfolio.

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**NBR: 252943** **ACRONYM: AMAAOOINCPOS** **EC FUND: 240289**

**DG:** REA **Call: FP7-PEOPLE-2009-IIF** **Thema:** FP7-PEOPLE-2009-IIF

**Title:** Architectures, morphologies and applications of organic/inorganic nanomaterials containing polyhedral oligomeric silsesquioxane

**Abstract:** Recently, novel nanomaterials with unprecedented properties have attracted great attention, due to the rapid requirement of the emerging technologies in the fields such as biology and microelectronics. In this project, we proposed a novel kind of nanomaterials, organic/inorganic hybirds containing polyhedral oligomeric silsesquioxane (POSS). POSS-containing hybrid polymers with unique architectures will be prepared using advanced polymer synthesis protocols. These hybrid polymers could self-assemble into a rich variety of morphologies in domains with periodicities such as lamellae in bulk or micelle in solution. We will carry out primary test of the resulting POSS-containing nanomaterials for drug delivery applications and explore many other applications such as catalysis and nanoreactors, microelectronics, molecular template, etc.

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**NBR: 252944** **ACRONYM: PICNQO** **EC FUND: 161248**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** A Plasmonic Interface to Carbon Nanotube Quantum Optics

**Abstract:** Since their discovery in 1991, single walled carbon nanotubes (SWNTs) have led to a worldwide explosion of research activities due to their outstanding electrical properties. Ten years later, the demonstration of optical emission from semiconducting SWNTs has opened a new field for nano-optics. In terms of quantum information processing, it has been recently shown that SWNTs are promising candidates for single spin quantum computing. Combined with their promising optical properties, this naturally promotes

SWNTs as an ideal system to fulfil a crucial goal in quantum information processing, i.e. to link solid state qubits used for information processing (single spins) with flying qubits used for transmitting quantum information (photons). Schemes aiming at manipulating spins in semiconducting nanotubes all-optically, and more general applications of quantum optics necessitate the ability to confine electrons and holes (excitons) in a small recombination region called an optical quantum dot. One significant disadvantage of SWNTs with respect to optics is that, unlike in epitaxially grown semiconducting heterostructures, there is no obvious way to controllably confine excitons. In the proposed project, I will engineer and control an optically active quantum dot in an ultraclean suspended nanotube by means of an innovative approach aiming at exploiting the nanotube many-body interactions, and study its far-field optical properties. In a second step, I will study the coupling of the defined quantum dot to surface plasmons via metallic nanowire guides. This will constitute an important step towards future buses for transferring quantum information at the nanoscale through on chip flying qubits. These two experiments will be realised in a new type of devices recently developed in the Quantum Transport group at TU Delft, using a new technology combining a set of local electrical gates acting on single ultraclean suspended nanotubes.

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**NBR: 252966** **ACRONYM: NANOMAGMA** **EC FUND: 172240**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** Nanocomposite magnetocaloric materials

**Abstract:** Worldwide a large part of produced electrical energy is used in inefficient vapour-compression cooling systems. Magnetic refrigeration near room-temperature has great potential to establish itself as a 21st century cooling technology and become an energy-efficient, environmentally friendly, cost-saving approach to replace the conventional technology. For successful operation of the magnetic refrigerator, the magnitude of the entropy change associated with the change of magnetic state of the active magnetic coolant is crucial and some materials including La(Fe,Si)13 are very attractive. Previous work has focused on optimising materials to enhance the magnetic properties of the parent compound, but it is clear that the operating field and the ability to create suitable thermal pathways are critical factors limiting industrial use. In this project we propose to use simple low-cost, scalable processing routes to develop novel nano-architectures to tackle thermal management and low operating fields. The magnetocaloric material La(Fe,Si)13 will be integrated into a percolating network of high thermal conductivity material e.g. Cu, alumina or carbon nanotubes. A number of approaches will be explored: solution, vapour phase and conventional powder processing. We will examine 1D, 2D and 3D nanocomposite structures to probe key issues such as effects of grain and particle size, strain, orientation and volume fraction of active material. Exploring intergrain exchange coupling of the La(Fe,Si)13 with a soft magnetic material of high moment such as □-Fe will address the issue of lowering the operating field. The project

will provide ample training opportunities for the IEF fellow in a range of complementary areas. We will establish structure-property relationships and develop fundamental physical models for single-phase and composite devices. This will allow rational design of magnetic refrigerant systems and be a major step towards industrial application of this technology.

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**NBR: 253048** **ACRONYM: 1DSOLVE** **EC FUND: 171740**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** Controlled exfoliation of one-dimensional nanostructures

**Abstract:** The aim of the proposed work here is to produce and characterise high quality dispersions of one-dimensional nano materials, unlocking their remarkable properties – properties that would be severely limited in their aggregated form, thus allowing researchers to realise their full potential. Single walled carbon nanotubes (SWNTs) and bacteria cellulose (BC) are examples of such materials and will be the focus of this work; they form aggregates that display dramatically inferior properties when compared to their isolated, debundled states and are both known to be insoluble in most common solvents. Thus, in order to exploit their superlative properties, this work aims to produce stable, high quality dispersions – where understanding the surface chemistry involved in such dispersions is seen as central. This project proposes to investigate the surface chemistry of SWNTs in the presence of gas phase dispersants using Inverse Gas Chromatography (ICG) (a technique highly sensitive to small changes in surface make-up). Interactions between dispersant and SWNT, seen as crucial to SWNT bundle exfoliation, will be identified. This study will allow for a much greater understanding of the criteria needed in SWNT dispersants. Knowledge of such criteria will be extended and adapted to charged SWNT solutions. Finally, we propose to investigate the solubilisation of Bacteria Cellulose Nano-Fibrils (BC). The exfoliation of these one-dimensional intractable solids will call on skills and knowledge gained from dispersing SWNTs. Exfoliation of the BC nanofibrils will be characterised in a range of suitable solvents leading to dispersions rich in debundled BC nanofibrils – dispersions that should lead to superior composites and applications.

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**NBR: 253055** **ACRONYM: OA AM** **EC FUND: 231089**

**DG:** REA **Call: FP7-PEOPLE-2009-IIF** **Thema:** FP7-PEOPLE-2009-IIF

**Title:** Articular Contact Mechanics with Application to Early Diagnosis of Osteoarthritis: Asymptotic Modelling of Biomechanical Contact Phenomena Under Dynamic and Impact Loading

**Abstract:** Around a quarter of the European population aged over 60 suffer from disability due to osteoarthritis (OA). The onset, progression, and severity of this degenerative joint disease is crucially influenced and controlled by mechanical factors in the articular cartilage system. Today, the ever-increasing complexity of mathematical models for articular contact mechanics comes in acute contradiction with the scientific striving for clear understanding of the underlying principles of AO pathology. One of the much used ways to simplify mathematical models is asymptotic modelling (AM), which is an asymptotic analysis based mathematical modelling approach to investigate complex multi-parametric and multidimensional systems. This proposal seeks to develop an advanced AM methodology for describing contact mechanics of articular joints under quasi-static, dynamic, and impact loading. The main research objectives are (1) develop elaborate multi-level asymptotic models for analytical evaluation of the sensitivity of the crucial parameters of articular contact mechanics due to small variations in thicknesses and biophysical microstructural properties of the contacting articular cartilage layers, including microcracking in articular calcified cartilage and OA-associated changes in the underlying bone tissue; (2) develop mathematical and computational models for time-dependent nanoindentation of articular cartilage suitable for a new recently emerged methodology for in situ health monitoring of articular cartilage and early detection of OA using indentation type atomic force microscopy; (3) implement the expected results of mathematical modelling and asymptotic analysis into computational simulation software. The proposed mathematical modelling project is intended to be carried out in close collaboration with the biomechanics research group, which has already established links with the target population of patients suffering from OA and the clinicians treating them.

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**NBR: 253063** **ACRONYM: CVM-EM-PALM** **EC FUND: 165645**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** Computing the structure and dynamics of protein assemblies in living cells by coupling sub-diffraction fluorescence microscopy with single-particle reconstruction: application to viral capsids

**Abstract:** Electron microscopy (EM) is an invaluable tool for investigating the nanometer-scale organization of molecular assemblies such as viruses, but is restricted to dead cells, does not readily label targeted proteins, and is prone to fixation artefacts. Recently developed methods to break the diffraction limit in optical microscopy have the potential to resolve protein arrangements in living cells. However, their resolution is currently restricted to ~20-30 nm, still an order of magnitude removed from EM, and dynamic super-resolution

imaging remains challenging. Here, we aim to reconstruct the protein arrangements of molecular structures at resolutions better than 20 nm by harnessing the power of statistics, i.e. by aggregating images from hundreds or thousands of copies of nearly-identical structures and when possible by exploiting their symmetry. To do this, we will adapt computational methods of single particle reconstruction from electron microscopy to super-resolution optical microscopy. After validation on synthetic data, we will test and apply these methods to nuclear pores and adenovirus capsids. These examples have been chosen because of their geometric features that work well with our approaches. Particularly, we are interested in obtaining novel insight into the dynamic structural changes occurring at the nuclear pore complex during active transport. Furthermore, we aim to decipher the sequence of events during viral capsid formation. This work has the potential to further push the resolution of optical microscopy towards that of electron microscopy for the analysis of ordered molecular assemblies. If successful, our project will open the door to structural investigations in living cells, including the assembly process of viral particles, or the plasticity of the nuclear pores and its role in nucleo-cytoplasmic transport.

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**NBR: 253085** **ACRONYM: SNB09** **EC FUND: 153917**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** Substrate nanopatterning by e-beam lithography to growth ordered arrays of III-Nitride nanodetectors: application to IR detectors, emitters, and new Solar Cells

**Abstract:** The overall objective of the proposed project is the development of novel optoelectronic and photonic devices based on ordered arrays of GaN/AlGAN and InGaN/GaN nanorods. The mechanisms of spontaneous nucleation and growth of such nanorods on Si substrates, under specific experimental conditions, have been recently clarified and understood. However, the realization of true devices relies on the achievement of ordered arrays of nanorods by localization of the epitaxial growth on predetermined preferential sites. This challenging issue would be tackled by controlling the growth of such heterostructures by plasma-assisted molecular beam epitaxy (PA-MBE) growth on nanomasks and nanopatterned substrates, and by the subsequent processing of the nanodevices arrays. Ordered growth following a predefined pattern is a critical step to allow subsequent applications. Nanomasks and nanopatterning will be achieved by e-beam lithography and dry etching. Three different devices will be developed as demonstrators, namely, arrays of nanophotodetectors in the IR, white light nanoLEDs, and nanocolumnar Solar Cells. It is worth to remark that all these devices are beyond the state-of-the-art and will benefit from the very high and unique crystal quality of nanorods. Other advantages of such nanostructures are a wide absorption surface and the capability to exploit Photonic Crystal effects for light extraction. The objectives of this project, being very ambitious, are perfectly feasible because all devices are based on the same basic structure of nanorod arrays (building block). The project, aside from very

relevant scientific aspects, will offer the young researcher a full training program on technological and complementary issues.

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**NBR: 253087** **ACRONYM: PROBI** **EC FUND: 117213**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** PRotein cOatings to prevent Bacterial Infections

**Abstract:** Biomaterials are revolutionising many aspects of preventive and therapeutic healthcare. They are already playing an important role in the development of new medical devices, prostheses, tissue repair and replacement technologies. This proposal addresses two of the most critical issues in biomaterials research: lack of knowledge of the fundamentals processes underlying interfacial interactions and bacterial infection. We will focus our research on materials used for ophthalmological implants and in particular on the ones used in the manufacturing of intra-ocular lenses for cataract surgery. We will study the interaction of Staphilococcus epidermidis with biomaterial surfaces with nanoscience techniques. Staphilococcus epidermidis ranks first among the causative agents of nosocomial infections. In particular, S. epidermidis represents the most common source of infections on indwelling medical devices. Based on the knowledge accumulated in recent years about the characteristics that make a successful biocompatible interface we propose to research on the properties of amphipatic fungal proteins Hydrophobins as a plausible candidate to modulate the biomaterial interface. In particular, we will investigate class I hydrophobin extracted from the basidiomycete fungus Pleurotus ostreatus, whose properties are only partially investigated. Several studies have shown that class I hydrophobins do not seem to be toxic or cytotoxic or immunogenic, thus they are susceptible to be used in various medical and technical applications. We propose to coat model surfaces with thin layers of native hydrophobin. The adhesion properties of the layer to the substrate as well as the wetting properties of the biofilm surfaces, will be fully investigated. Subsequently interaction of bacteria with hydrophobin coated surfaces will be investigated. The goal is to obtain information about the factors that may reduce the incidence of infections due to bacterial colonization on biomaterials.

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**NBR: 253104** **ACRONYM: HARMONICS-PLASMA** **EC FUND: 240289**

**DG:** REA **Call: FP7-PEOPLE-2009-IIF** **Thema:** FP7-PEOPLE-2009-IIF

**Title:** HARMONIC GENERATION IN EXTREME ULTRAVIOLET REGION THROUGH THE INTERACTION OF SHORT LASER PULSES WITH LOW-EXCITED LASER-PRODUCED PLASMA AND GAS JETS

**Abstract:** High-order harmonic generation (HHG) is an increasingly used and promising technique for achieving the extreme ultraviolet (XUV) spectral range with highest brightness, short pulse duration, and coherence. Extensive studies of this phenomenon have been mostly carried out using jets of neutral atomic gas, which have resulted in novel coherent XUV sources. However, typically observed high-order harmonics presently have the disadvantage of low conversion efficiency (10-6). This is problematic for many potential applications of HHG radiation including XUV coherent diffraction imaging, time-resolved measurements, and seeding of Free Electron Lasers. Recent studies have shown that this weakness can be partially overcome by using the ablated plasma as a nonlinear medium. An especially interesting observation, unique for harmonics originated both from gas jets, surfaces, or plasma, is the enhancement of a single harmonic, attributed to resonance with a strong radiative transition. In this way, conversion efficiencies higher than 10-5 from the pump laser radiation to the harmonics in the plateau range have been reported. The project is aimed at the enhancement of HHG efficiency from laser ablation produced on the surfaces of solid-state materials and comparison with HHG from gas jets. The milestones of the proposed investigations include (a) analysis and optimization of harmonic generation from laser plasma produced on the surface of various targets, (b) search of resonance-induced enhancement of single harmonic in the XUV range, (c) harmonic generation from the laser plumes containing nanoclusters, (d) search of the continuum in the harmonic emission near the cutoff (a characteristic signature for attosecond pulse generation), and (e) HHG from gas jets and comparison with the HHG from laser plasma. As a result of project, further improvements of the harmonic efficiency in the XUV range through the HHG from laser plasma and gas jets will be achieved.

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**NBR: 253129** **ACRONYM: UNIMETCLUST** **EC FUND: 241761**

**DG:** REA **Call: FP7-PEOPLE-2009-IOF** **Thema:** FP7-PEOPLE-2009-IOF

**Title:** Study of uniform supported metal complexes and metal clusters at atomic level for catalytic applications

**Abstract:** The discovery and optimization of materials with nanometric dimensions (e.g. supported metal clusters) has aroused high interest in catalysis field during the last years. Based on the fact that some elements, such as gold, show unique catalytic properties when properly synthesized in the form of small crystallites, attention has been mainly paid on controlling the physical-chemical characteristics of the supported nanoparticles at atomic scale, taking into account that this matter is crucial for designing more active and selective catalysts. Particularly, the possibilities of supported metal species containing

only a small number of atoms (1–10 metal atoms) are of high interest for application in catalysis, since they no longer act like bulk metals, but tend to offer unique properties in the activation of chemical functionalities. During the present project, we will tackle the synthesis, characterization and reactivity of supported metal complexes, and small metal clusters, for producing solid metal-based materials with properties close the molecular analogues. A hypothesis underlying the research is that these well-defined supported species play a key role in advancing the fundamental understanding of catalysis, in such a way that the study of much more complex nanoparticulated materials (industrial catalysts) can be built on the foundation of this research.

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**NBR: 253166** **ACRONYM: PALMSEP** **EC FUND: 173065**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** Septin organization by multiparameter photoactivated localization microscopy

**Abstract:** The septins are a conserved family of GTPases that interact with membranes and the cytoskeleton. Several different septin molecules combine into nonpolar dimeric rods. These rods are thought to assemble end-over-end into higher order structures that orchestrate complex cellular events at the interface of the cytoskeleton and the plasma membrane. In this way, septin complexes organize the cleavage furrow in dividing cells, serve as a corset to maintain cell shape in cell motility, engulf invading bacteria and control the morphological differentiation of nerve cells. The integrity of the complexes is essential for septin function. However, the architecture of septin complexes and the rules guiding their assembly, while seemingly conserved from yeast to mammals, are not clear. The main objective of this study is thus to understand the rules controlling the assembly of septin complexes from subunit rods in yeast and mammals and to find out, whether there are alternative models to end-over-end assembly of septin rods into complexes. Individual septin rods will be localized within complexes with nanometer precision using ultra-resolution fluorescence microscopy methods. The septin complex architecture will then be modeled from the resulting pattern of individual rod positions. As a starting point, the best-understood septin complex, the ring-shaped complex at the mother bud neck in yeast involved in cytokinesis, will be investigated. First conclusions from the analysis of this complex will aid in the investigation of a mammalian septin complex at the neck of dendritic spines in neurons. Neither the precise composition nor the global structure of this septin complex are known yet, but morphological and functional analogies of the spine neck with the yeast bud neck suggest that a similar septin-ring structure may be present. The expected results will clarify the role of the septin complexes in yeast cell division and define the rules for septin complex assembly in neurons.

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**NBR: 253187** **ACRONYM: METATUNE** **EC FUND: 180603**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** TUNABLE NONLINEAR METAMATERIALS

**Abstract:** A metamaterial is a material which gains its properties from its structure rather than directly from its materials composition. Within the context of photonics, such compounds are engineered composites that exhibit superior, designed properties that are not found in nature and not observed in the constituent materials. They have demonstrated many intriguing properties and applications for control over electromagnetic waves such as negative refraction, superlensing, and cloaking devices. Metamaterials have the potential to develop into a highly disruptive technology over the whole electromagnetic spectrum, ranging from more efficient radiofrequency antennas to the marriage of nanoscience and photonics for a whole new generation of optoelectronic devices. Since the first studies on negative-index metamaterials, the attention of most researchers has been focused on the passive control and linear properties of these composite structures, where the effective parameters of the structure do not depend on the intensity of the applied field or propagating electromagnetic waves. However, to achieve the full potential of the unique properties of the metamaterials requires the ability to dynamically control the material's properties in real time through either direct external tuning or nonlinear responses.

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**NBR: 253214** **ACRONYM: SPINTORQOSC** **EC FUND: 234337**

**DG:** REA **Call: FP7-PEOPLE-2009-IOF** **Thema:** FP7-PEOPLE-2009-IOF

**Title:** Spin torque oscillators with applications in non digital computing science and communications.

**Abstract:** The project aims at studying spin-wave excitations from nanocontacts and implementing biological inspired computations with wavefronts in nano-structures, likely in terms of spin waves in ferromagnetic films. This implies building a bridge between Mathematical Neuroscience and Applied Physics. It is also of great importance to create a new research line at the \emph{Magnetics Laboratory Group} at UB with Prof. J. Tejada and Dr. J. M. Hernandez based on nanofabrication of magnetic devices sensors in order to study gyromagnetic phenomena and the patterning of spin dynamics at the quantum level. Nanoscale, current controlled spin-torque oscillators (STOs) are of great fundamental interest and also of interest for signal processing and communication, including on-chip communication via spin-wave propagation. However, the fundamental characteristics of the spin-waves emitted by STOs are unknown. STOs, consisting of a point contact to a thin film ferromagnet (FM), were first proposed theoretically in 1996.

High DC current densities generate a high-frequency dynamic response (up to 100 GHz) in the FM layer and can result in the emission of spin-waves. Studies of STOs to date have relied primarily on electronic transport characteristics. Further studies have shown these oscillations may be phase-locked to an external rf source, via a process known as injection locking, providing a means of conducting time-resolved spatial imaging. The aim of the proposed work is to study the fundamental characteristics of spin-waves generated from STOs using full-field transmission x-ray microscopy (TXM), combined with x-ray magnetic circular dichronism (XMCD) to provide magnetic contrast. We will determine the physical requirements for implementation with STO's of a novel computational framework based on polychronous wavefront dynamics using temporal and spatial patterns of activity in pulse-propagating media.

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**NBR: 253221** **ACRONYM: CYLREC** **EC FUND: 180603**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** Novel Supramolecular cylinders and their interaction with DNA

**Abstract:** The scientific aim of this proposed project is to understand what features of nanoscale synthetic cylinders, and which biomolecular binding mode, give rise to the observed biological effects on the cell cycle and to probe the mechanism and temporal relationships of that action in more detail. Our hypothesis is that the cylinder recognition of Y-shaped junctions, particularly replication forks, is a key feature of their action. The new design strategies will create cylinders which deconvolute the two different DNA binding modes (Y-shaped junction or major groove) and are founded on careful analysis of the X-ray structure of the 3 way junction and an NMR structure of the major groove binding: the designs add functionality to prevent one of these two binding modes while permitting the other. Within each overall design strategy, a number of different cylinders are proposed and, as detailed, the results of the biophysical and cell delivery studies will be used to optimise the design and select the most suited.

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**NBR: 253243** **ACRONYM: NANOSPID2** **EC FUND: 160748**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** Nanowires for single photon detection and spin memory devices

**Abstract:** The ultimate limit in the miniaturization of electronics and photonics is at the nanometer scale. Here the signal level can be controlled at the fundamental level of a single electron and a single photon. These limits are actively being pursued for scientific interest with possible applications in the area of quantum information processing and

communication. We propose novel devices aimed at single photon detection and single spin memory using nanowires. The basic building block is a III-V quantum dot defined in a Si nanowire. We will develop the following technology: (1) growth of complex semiconductor nanowire, (2) quantum state storage and transfer onto a photon state for the memory device, and (3) single photon detection and electron multiplication for single photon detection. The nanowires will be grown by the vapor-liquid-solid mechanism. The structures and devices obtained after growth and each nanofabrication steps will be thoroughly characterized and the final test devices performances will be evaluated.

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**NBR: 253254** **ACRONYM: ELECTROSCO** **EC FUND: 153417**

**DG:** REA **Call: FP7-PEOPLE-2009-IIF** **Thema:** FP7-PEOPLE-2009-IIF

**Title:** Tailoring crossover properties by electric field in nano-structural and liquid crystalline molecular based magnetic materials

**Abstract:** Spin crossover (SCO) systems are functional molecular materials possessing labile electronic configurations switchable between the high- (HS) and low-spin (LS) states in response to external stimuli (temperature, pressure, light, sorption, phase transition). In the HS and LS states SCO materials reveal differences in magnetism, optical and dielectric properties, colour and structure. SCO materials are one of the most important examples of bistable molecular materials with potential applications as sensors, electronic memories and in opto-electronics. A rational control of the SCO-properties is required, in particular at nano-metric scale, if they have to be successfully integrated into functional devices. The present research proposal has two research lines. The first one includes: 1a) Development of nano-structured cooperative spin crossover metallorganic frameworks (SCO-MOFs) following the 'bottom-up' synthetic approach; 1b) Nanoscale patterning of SCO-MOFs; 1c) Detection of magnetic, optical and dielectric bistability in SCO-MOFs at nanometric scale in external electric field. The second line will be guided towards: 2a) Development and investigation of new charged and neutral SCO systems with liquid crystalline properties (SCO-LSs) with strong intermolecular hydrogen bonding; 2b) Study of SCO properties of SCO-LCs under external electric field.

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**NBR: 253369** **ACRONYM: MULTIMOF** **EC FUND: 173240**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** Multifunctional Metal-Organic Frameworks

**Abstract:** The project MultiMOF (Multifunctional Metal-Organic Frameworks) is a natural step beyond the work developed by the applicant during his PhD thesis in Molecular Magnetism. It intends to undertake an extensive scientific program on the design and physical characterization of a broad range of multifunctional Metal-Organic Frameworks (MOFs). Mutifunctionality will arise from the combination of their intrinsic properties such as lightness, porosity, flexibility or biocompatibility with magnetism or chirality and the interplay between them. MOFs can be defined as nanoporous crystalline compounds consisting of metal ions or clusters coordinated to multidentate organic ligands to form one-, two-, or three-dimensional structures. Resulting from the introduction of permanent porosity, these molecule-based materials have attracted important attention in the last decade because of their promising application in gas storage, separation, ion exchange, catalysis or drug delivery. Taking advantage of expertise of the University of Liverpool materials chemistry group in the synthesis and characterization of MOFs, we intend to introduce electronically active transition metal (TM) extended units and optically active organic linkers in these materials in order to combine magnetic or optical properties with those resulting from their open structure. This approach will result in the design of a whole set of magnetic MOFs including additional functionalities, which could be of remarkable importance for the future development of porous low-density magnetic materials, switchable magnets, chiral magnets, magnetic sensors or higher level multifunctional materials. In this way, the researcher will embark on a multidisciplinary work plan, learning new concepts in Coordination Chemistry and Crystal Engineering, essential for the design and isolation of these open frameworks, and Solid-State Physics, employed in the study and tuning of physical properties exhibited by these materials.

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**NBR: 253445** **ACRONYM: SUNARQ** **EC FUND: 154417**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** Novel sunlight-active nanoarquitectures for environmental and human health protection studied with a new multi-technique methodology at operando conditions

**Abstract:** The main goal of this project is to develop novel environmental friendly photocatalysts. The work would follow three principal directions: 1.Synthesis of novel heterogeneous TiO2 catalysts 2.Identification of the reaction mechanism 3.Applications in environmental/human-health problems, such as priority organic pollutants and harmful microorganisms in gas and liquid phase. Many of the photocatalytic reactions reported so far are activated by UV light and do not exploit the “green” potential of the method. Here, new TiO2 catalysts will be developed to achieve efficient photocatalytic activity in the visible light range based on: i) the exhaustive exploration of co-doping of TiO2 controlled nanoarquitectures (size/shape) with metallic (Fe, V, W) and nonmetallic (N) ions. ii) Synthesis of novel hybrid TiO2 based biomaterial with an inorganic component based in step i) or alternative sunlight-active photocatalysts. These materials pose

extended antimicrobial activities and will allow production of thin films and/or membranes. Polymer-oxide materials act as true “remote” photocatalytic systems, eliminating the need of direct contact between the photoactive oxide and the pollutants. They will be used for biological and/or chemical depollution, with easy recovery and reuse and long term stability, eliminating most of the drawbacks of powder TiO2 based photocatalysts. For the solid characterization and the identification of the reaction mechanism a joint and not explored Electron Paramagnetic Resonance, Diffuse Reflectance Infrared Spectroscopy, X-ray Absorption Spectroscopy and computational chemistry approach will be used. Emphasis will be put on the innovative use of time-resolved spectroscopies in a “differential mode” at real “operando” conditions and theoretical interpretation to unravel most important aspects of charge carrier handling, e.g. capture and fate while at surface and to firmly establish structure-activity relationships.

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**NBR: 253477** **ACRONYM: PEPS-PROPOSAL** **EC FUND: 163661**

**DG:** REA **Call: FP7-PEOPLE-2009-IIF** **Thema:** FP7-PEOPLE-2009-IIF

**Title:** New techniques in the simulation of quantum many-body systems in two dimensions: methods and applications

**Abstract:** A number of recent results in the field of quantum information science have lead to new and fresh ideas to attack old, long-standing problems in condensed matter physics. The study of quantum correlations (or entanglement) has motivated the development of a host of new promising methods to numerically simulate the physics of quantum many-body systems. Based on this, the aim of this project is to build new techniques to understand the physics of strongly correlated quantum systems in two dimensions. The expected outcome is a numerical package that will be amongst the best tools to understand the quantum-mechanical properties of these systems, in turn contributing to the study of the universal theory of quantum phase transitions and our understanding of quantum states of matter in Nature. These methods are also expected to a have significant impact in fields such as condensed matter physics, quantum-atom optics, lattice high-energy physics, quantum information and computation, and nanotechnology.

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**NBR: 253521** **ACRONYM: SMARTPIEZOCOMPOSITE** **EC FUND: 168969**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** Crystallization of Polymers in the Presence of Inorganic Nanoparticles - a Way Towards Piezoelectric 'Smart' Nanocomposites

**Abstract:** The project proposal addresses field of ‘smart’ piezoelectric materials based on polymer-inorganic nanocomposites. The research will be divided into following main sub-streams: investigation of nanocomposites based on poly(vinylidene fluoride), investigation of materials based on poly(L-lactic acid) and study on the influence of differently shaped nanoparticles on crystallization and general phase behavior of the materials. For the purpose of this project, the nanocomposites will be prepared by compounding either in solution or in the melt and also by methods based on chemical synthesis. The main efforts will be directed at finding factors essentially affecting polymer-nanoparticle interactions in order to control both the polymorphism and mutual orientation of nanoparticles and structure units at the nanoscale. Achieving this goal is crucial as it defines the possibility to render the materials piezoelectric. It is expected that spatial orientation of anisometric nanoparticles in the molten polymer matrix will force the polymers to crystallize in certain preferred direction and crystal structure, which will enable formation of piezoelectric materials using simple methods typical for processing of thermoplastics as e.g. injection molding. From the technological point of view, such an improvement will allow to simplify the production methods of piezoelectric plastics and also will reduce the production costs of such materials. Currently, the state-of-the-art piezoelectric polymers are processed mainly to the form of foils and fibers, which limits the area of their possible application in devices. The main improvement proposed in this research relies on the possibility to process the nanostructured material to complex geometries, which will expand the field of potential application – especially in robotics, measuring devices and monitoring systems.

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**NBR: 253532** **ACRONYM: RIANS** **EC FUND: 179603**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** Rydberg Interactions at Nanostructured Surfaces

**Abstract:** The applicant will move from France to the UK to carry out novel experimental studies of the interaction and ionization of laser-excited Rydberg atoms and molecules at a nanostructured metallic surface under UHV conditions. Of primary interest is to understand how the charge transfer process occurring is dependent on the spectroscopically selected quantum states of the Rydberg species, the electronic and geometrical structure of the surface, and on the relative sizes of the nanoparticles and the Rydberg orbital. The experimental work will be backed up with theoretical wavepacket calculations of the Rydberg electron dynamics. The Fellow will transfer his expertise and experience built up in atom-chip, ultracold atom and molecule experiments in Physics laboratories in France and China to the Oxford host research group and its collaborators, while gaining new experience and knowledge of surface

science, molecular laser spectroscopy techniques and theory in the Chemistry department at Oxford. The objective is to prepare him for interdisciplinary experimentation in the future, and for an academic career. He will be enrolled on the Preparation for Academic Practice course at Oxford in support of his objective to obtain an academic career.

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**NBR: 253548** **ACRONYM: MAN** **EC FUND: 162248**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** Mechanical Analysis of Nanocomposites: an experimental and computational study of the mechanical behavior of polycrystalline and tough nanocomposite structures.

**Abstract:** Nanocomposite structures show enhanced mechanical properties (hardness and toughness) which are very interesting for protective purpose. The mechanical behavior of those materials is still not clear, and many different explanations (often contradictory) are present in the literature, which makes difficult the practical application of Nanocomposites. This project proposes to study the deformation mechanisms of these structures by a combined experimental and theoretical (computational) approach. This original approach will allow understanding phenomena which were still unapproachable until a few years ago and to clarify at once, the particular behavior of Nanocomposite structures. From the experimental side, a set of thin films with the abovementioned structures will be prepared by magnetron sputtering and characterized by several techniques, such as XRD, TEM, EELS, SEM, XPS, etc. Mechanical properties will be measured by nanoindentation. Further specific measurements will also be done for some selected samples, in order to evaluate “in situ” the deformation of these materials under stress by SEM, TEM/ED and XRD from a synchrotron source. From the theoretical side, molecular dynamics (MD) simulations will be done to evaluate the role of the crystal size, phase composition and presence of impurities in nanocomposite structures (and polycrystalline ones for comparison). The new knowledge, know-how and tools developed during this project will contribute to bring EU on the forefront of nanocomposite structures and their applications. Together with a training aiming at expending both technical skills (e.g in the field of nanoindentation, diffraction, TEM) and soft-skills (e.g. science management), this project will allow placing the candidate on his path for becoming a leading expert in the field of nanocomposites. In conclusion, this project will have a great impact not only on the researcher, but also on the participating institutions, and in Europe by extension.

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**NBR: 253602** **ACRONYM: SOLAR BIO-HYDROGEN** **EC FUND: 181103**

**DG:** REA **Call: FP7-PEOPLE-2009-IIF** **Thema:** FP7-PEOPLE-2009-IIF

**Title:** Design of Hybrid Nanostructured Bio-photocatalyst for Their Application in Bio-photoelectrochemical Hydrogen Production

**Abstract:** The need to establish renewable energy supplies, both as a strategic economic requirement and as a wedge against climate change is leading organizations to invest in research on capturing solar energy. There is particular interest in artificial photosynthesis, using photons to produce electricity or fuels using a man-made device rather than a plant. In natural in-vitro system for hydrogen production, complex molecule i.e. chlorophyll harvest solar energy and subsequent electronic excitation leads to ejection of electrons from the chlorophyll dimer and then passed on to various electron-transferring mediators. This electron donor system may be replaced with the visible light sensitized inorganic photocatalyst. At present, the photocatalysts that have been synthesized and tested fall far short of the efficiency and catalytic rates of enzymes that catalyze either H2 production (hydrogenases) or O2 production (the Mn cofactor of Photosystem II). Therefore the enzymes themselves represent important benchmarks for gauging the possibilities for building water-splitting photocatalysts from inorganic and organic photophysical materials. In such devices enzyme molecules are linked to the semiconductor surface in such a way that they are stable and electrocatalytically active. Therefore, the proposed project is focused on the fabrication of chalcogenide semiconducting nanostructures (mainly nanotubes / nanowire / gyroid having few nm thick wall) and grafting of redox proteins onto these nanostructures for their subsequent exploitation in photoelectrochemical hydrogen production. The exploration of the photoelectrochemistry involved and properties of enzymes which govern the hydrogen generation will also be undertaken. In addition, various other parameters such as the electrolyte pH, nature of sacrificial reagents, combination of chalcogenide photocatalyst- redox proteins (eg. Hydrogenase etc.) will be optimized to maximize solar hydrogen production efficiency.

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**NBR: 253603** **ACRONYM: MULTIMOF** **EC FUND: 161748**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** Preparation of Multi-Functional Metal Organic Frameworks catalysts

**Abstract:** The overall aim of this project is to engineer new mono and multifunctional nanostructured solids to be used as catalyst for multi-step, one-pot reactions. The key objectives are: 1. Create stable nano-structured super basic catalysts based on Metal Organic Frameworks (MOFs) by using synthetic and/or post-synthetic approaches. 2. Create nano-structured solids containing covalently bonded sulphonic groups by using synthetic and/or post synthetic methods. 3. Create acid MOFs with metal nanoparticles encapsulated in the MOF cavities (acid-metallic catalyst). 4. Produce acid-base MOFs by

using synthetic and/or post synthetic approaches. The main motivations for the exploration and development of efficient catalysts are to conserve energy, to produce fine chemicals and to develop environmentally friendly and safe technologies. Despite major improvements over the past few decades, many existing commercial catalysts are still plagued by low efficiency, high cost, and/or production of large quantities of hazardous wastes. Furthermore, many of them have been designed to catalyze a single reaction in multi-step reactions or to produce multiple products, in contrast to industry's needs for efficient multi-step, one-pot catalytic processes. The tailoring of multifunctional catalysts is a big challenge for the research community and for the society in general, since proper catalysts may reduce the economical and environmental costs of crucial catalytic process. Multifunctionality in heterogeneous catalysis has been scarcely studied, with respect to multifunctional solids, the heterogeneous catalysis toolbox is still empty. In this sense MOFs are called to play an important role in the near future due to their wide chemical versatility and modifiability. The emphasis and final target of this proposal is to design and to apply MOFs as bi-functional catalysts. The main part of the proposed project, will be carried out at the Delft University of Technology, abbreviated as TU

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**NBR: 253626** **ACRONYM: NONPLASMETA** **EC FUND: 180603**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** Nonlinear Plasmonic Metamaterials

**Abstract:** The main goal of the proposed research project is the modelling and theoretical analysis of a new class of artificial metamaterials exhibiting a strong nonlinear optical response at visible and near-infrared frequencies.The promising properties of these new photonic materials are assisted by surface plasmon polaritons supported by the metallic subunits forming the metamaterial. The nonlinear response can be due not only to the metallic nanostructures, but also to the presence of nonlinearities in the substrate or embedding layer. The investigation on nonlinear plasmonic metamaterials combines three of the most active and fruitful research areas in photonics during the last decade: plasmonics, metamaterials science and nonlinear optics. Despite of the crucial importance of nonlinear effects in current photonic applications (such as laser and imaging technologies), nonlinear processes have not been yet incorporated into the metamaterial approach. In my research, I will take advantage of nonlinear effects to develop metamaterials at visible and near-infrared frequencies by overcoming the high absorption that electromagnetic fields suffer when propagating within metallic structures. The study of nonlinear plasmonic metamaterials may lead to the discovery of novel optical properties not found in nature. The profound comprehension of the fundamental physics behind these new photonic materials lies at the core of this proposal. However, the technological implications of this research project are clear. Nonlinear plasmonic metamaterials will open the way to the design of actively

controlled and multi-functional optical materials which are the first step towards a new generation of highly effective optical devices such as switchers, routers, intelligent surfaces and subwavelength imaging devices.

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**NBR: 253731** **ACRONYM: DIVAN** **EC FUND: 120394**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** Discrete Volume Assembly at Nano-Scale

**Abstract:** The objective of DIVAN is to develop a robust, potentially industrially viable process for the discrete assembly of individual Carbon Nano Tubes (CNTs). This competence allows realising devices and applications in which individual CNTs are integrated with micro-scale structures, to provide unique performance or new functions. Applications can be found in sensors, scientific instruments, and a wide variety of nanoelectronic devices like switches. A CNT is a cylindrically shaped nanostructure composed of carbon hexagons. CNTs are grown on a substrate in large numbers using a chemical process. Currently there is no viable method to volume assembly of discrete CNTs. DIVAN aims to rationalise the nano-scale assembly process by developing a set of linkable basic assembly operations. Basic operations include sorting, characterisation, handling and placement of CNTs. The basic assembly operations can be linked together to form complete assembly process chains for bringing CNTs from their fabricated state to their assembled and interconnected state. An essential contribution of the project to the field is the development of an assembly theory for nano-scale assembly. This assembly theory defines the boundary conditions for the assembly operations to be developed, and provides the backbone for structured design and evaluation of nano-scale assembly processes for specific cases. In this way, a systematic engineering and production perspective is added to the predominantly fundamental research oriented field of nanotechnology. Innovative principles for implementing the basic operations will be investigated, including the use of micro-fluidic devices to dispense CNTs, and the use of micro-scale handling structures. A benchmark device, a NEMS accelerometer, will be realised to evaluate and demonstrate the developed processes. An essential criterion is that the assembly processes have to be compatible with microfabrication processes to ensure volume upscalability.

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**NBR: 253914** **ACRONYM: EFFIBUILDINGS** **EC FUND: 107027**

**DG:** REA **Call: FP7-PEOPLE-2009-IIF** **Thema:** FP7-PEOPLE-2009-IIF

**Title:** Thermal energy storage with phase change materials for energy efficiency of European building stock

**Abstract:** The use of phase change materials (PCM) for thermal storage has attracted researchers in all over the world, mainly due to their large energy storage density, which is available within a narrow temperature range. There is unlimited number of possible applications where PCMs can be used such as buildings, glass houses, cold stores, refrigerated trucks and cooling of electronic devices. Work on PCMs has been ongoing for decades but their commercial use is still limited due to their high production and encapsulation costs. The project described in this proposal aims to develop a new technology for the production of PCMs from waste products and also to develop innovate methods of encapsulating these materials so they can be used in these different applications. Also since most of the commercial microencapsulated PCM products have not been fully tested for mechanical strength, a new technique of testing will be applied using for example nano-indentation technique. Prof. Farid has more than 25 years of experience working on PCM production and encapsulation. In PCM application, Farid will introduce his new approach of using PCM in building materials such as timber, using vacuum impregnation. To our knowledge, this has never been applied before and will lead to significant increase in the thermal mass of timber homes used in Northern Europe and other countries. Also based on his New Zealand's expertise in food storage, he will develop a suitable method of encapsulating low temperature PCM for temperature regulation of cold stores and refrigerated trucks, which is important to most European countries. The main objective of the proposal is to host Prof. Farid who will introduce the valuable knowledge of a third country (New Zealand in this case) into Europe. The participation of Prof. Cabeza in Cost Action TU0802 will help to disseminate this knowledge to most groups working with PCM in building applications within Europe.

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**NBR: 253917** **ACRONYM: STROKECELLFUSION** **EC FUND: 152917**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** Cell fusion as regenerative tool for stroke treatment

**Abstract:** In the last years it has been shown that transplanted adult bone marrow derived stem cells (BMSCs) have the ability to fuse with cells of other types and restore several pathologies such as congenital liver failure and muscular dystrophy. On the nervous system, it was recently reported that bone marrow transplantation (BMT) made 24 hours after the stroke leads to a functional outcome. Cell fusion is one of the underlying mechanisms as it has been shown that it is indirectly implicated in the formation of vasculature after stroke. Thus, stroke is a pathology susceptible to be treated with this cell therapy mechanism. Despite the great potential of this mechanism of regeneration, the low frequency of fusion events, especially in the brain, has veiled and hindered the true regenerative potential of cell fusion. Therefore, the main objective of this project is

to identify fusogenic factors that will increase cell fusion events to an effective level for cell therapy of neurological disorders. For this, firstly we will screen in vitro new putative fusogenic with the help of an in vitro cell fusion detection system and FACS analysis. Later, chitosan nanoparticles will be developed for the controlled release of the putative fusogenic factors. Finally, we will evaluate the in vivo efficacy of these factors trough a series of intravenous BMT co-administered with nanoparticles loaded with the selected factors in the mouse model of stroke. We will correlate an increment in the cell fusion events with the putative improvement in stroke symptoms. With this project we will improve our knowledge about adult stem cell plasticity and explore cell fusion process as a neuroregenerative process for the treatment of stroke.

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**NBR: 253971** **ACRONYM: ICROS** **EC FUND: 172740**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** Cancer associated glycan epitopes via Ionic Catch and Release Oligosaccharide Synthesis (ICROS)

**Abstract:** The quest for an effective cancer vaccine was initiated over 100 years ago from the moment vaccines against infectious diseases were successfully applied, and despite the many advances to date, the search for therapeutic vaccines derived from carbohydrate antigens is still an ongoing challenge. Carbohydrate antigens of tumour cells are uniquely effective targets for antibody-mediated active and passive cancer immunotherapy and have also proven to be effective targets for immune recognition and attack. The gastrointestinal tract posses a protective epithelial barrier as part of the basic innate protective system, which produces a secreted mucus layer that contains hundreds of different mucin type O-linked oligosaccharides known to be connected with diseases such as breast and colon cancers. However, little is known about the specific role of this family of oligosaccharides in disease due to the lack of tools for study. Access to structurally defined complex carbohydrates is still a very laborious process and combinatorial approaches to prepare diverse libraries of oligosaccharides remain limited. A general automated method for oligosaccharide assembly will allow rapid preparation of structures of interest. This programme's long term aim is to develop carbohydrate-based cancer vaccines that elicit both a strong humoral- and cellular immune response against colon and breast cancers. To achieve our objectives, we plan to apply a novel and improved methodology (ICROS) to the synthesis of mucin type carbohydrate fragments, which are otherwise not available, ready to be immobilized onto nanocarrier systems for initial biological (antibody screening) and immunogenic assays. The understanding of these glycosylation patterns at both molecular and functional level will help us identify mucin oligosaccharide based antigens that will pave the way to the development of target specific anti cancer vaccines.

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**NBR: 253980** **ACRONYM: DYNANIMAG** **EC FUND: 173240**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** Towards a unified description of dynamics and anisotropy in nanomagnets

**Abstract:** This proposal aims to develop a common framework to describe the properties of Molecular Nanomagnets (MNM) and Magnetic Nanoparticles (MNP). We will study the magnetic anisotropy and the spin dynamics in such nanomagnets. The former is the critical and fundamental property for application of nanomagnets as novel ultrahigh density magnetic data storage devices. We will investigate both types of nanomagnets using a wide range of experimental techniques under similar conditions allowing direct comparison of their properties. We will further the knowledge and understanding of the origin of magnetic anisotropy in both types of nanomagnets, leading to a generalized description of this property. The outcomes of this project will outline the way to the development of vastly improved data storage materials. In addition, we will study the spin dynamics using pulsed electron spin resonance. Detailed investigations of the spin-lattice relaxation will elucidate the microscopic mechanisms of magnetization relaxation, especially in nanomagnets with large spin state densities. Investigation of spin-spin relaxation will establish the possibility of measurable quantum coherence in large MNM as well as in MNP. This will further our understanding of how the quantum world of small particles transforms into the classical world that we live in. The outcomes will also allow assessment of the suitability of nanomagnets for quantum computing applications. The project will deliver a highly trained promising researcher accelerating his progress towards becoming a leading independent researcher. The detailed Career Development Plan ensures extensive scientific and complementary training. The project also foresees a number of research visits in various EU laboratories enhancing the experience and mobility of the researcher. The planned dissemination activities will also stimulate public engagement with science.

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**NBR: 254009** **ACRONYM: FUNSURF** **EC FUND: 159100**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** Functional Supramolecular Networks on Surfaces

**Abstract:** FUNSURF is an interdisciplinary research project which lies at a natural meeting point between chemistry, physics, materials science and nanotechnology. The project will enable a bright young scientist with an impressive track record to gain a high level of cross-disciplinary training in diverse new aspects of supramolecular self-assembly and reactivity, scanning probe microscopy, photochemistry and optical spectroscopy. The training-through-research basis of FUNSURF focuses on the design, synthesis and

characterisation of functional supramolecular networks on surfaces. Many of the structures produced by supramolecular self-assembly display high levels of spatial order making it an ideal method for producing the next generation of functional nanostructured devices. In addition to producing novel, high impact science this project gives the researcher the opportunity to work in an internationally recognised group at a host organisation which provides excellent postgraduate training in both scientific and complementary professional skills. FUNSURF will produce molecular architectures which can be activated by external stimuli to perform specific functions. These include, switching on or off adsorption sites in a network via optically induced changes in molecular configuration and initiating localised chemical reactions. Alongside this the development of Tip-Enhanced Raman Spectroscopy (TERS) will provide a chemically specific characterisation tool with nanoscale resolution. The researcher's background makes him perfectly suited to achieving these objectives, while the experience of new research disciplines will allow him to cultivate the broad range of skills key to driving new scientific developments in this area. This combination of training and interdisciplinary experience is essential in assuring the researcher attains an independent position at the forefront of future research efforts.

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**NBR: 254060** **ACRONYM: COCHLEAR SENSOR** **EC FUND: 120144**

**DG:** REA **Call: FP7-PEOPLE-2009-IIF** **Thema:** FP7-PEOPLE-2009-IIF

**Title:** Development of high sensitivity, wide dynamic range, mechanoelectrical transducer integrating artificial hair cell with artificial neurons.

**Abstract:** The human ear distinguishes sounds with astonishing sensitivity. It is able to resolve frequencies differing by 0.2% over 130 decibels of intensity. To achieve this feat the ear combines different strategies which we will implement in sensors of unprecedented sensitivity. The ear uses the power of Brownian noise in the cochlear fluid to enhance the detection of weak periodic signals. Each frequency is analyzed by specialized auditory hair cells which have different lengths and use a property called negative stiffness to enhance detection sensitivity. The incoming fellow has recently proposed a theoretical scheme for amplification by negative stiffness which he has demonstrated using a bench top experiment. Through a series of recent papers, the host group has conceived and studied a biomimetic neuron which sums and thresholds electrical pulses. In particular, the neuron demonstrates the amplification of useful signals by random noise using a property known as stochastic resonance. The present project will integrate artificial hair cells with semiconductor neurons to deliver highly sensitive, low power, scalable mechano-electrical transducers. We will study the amplification properties of the hair-neuron system. We will then integrate artificial hairs on neurons to make an artificial cochlea of microscopic size. We will fabricate hairs of different length/diameter aspect ratio to detect specific audio frequencies and code the sound intensity in the firing rate of the neuron. This fellowship will thus prepare the next generation of hearing

aids, hydrophones and voice recognition systems by incorporating advances in non-linear physics and nanoscience in our cochlear sensor. The sensor will improve the range of sub-marine detection and lead to smarter, smaller hearing aids thanks to the monolithic integration of the receiver with the neural network. The fellowship will establish a EU-Korea pole of collaboration in this multidisciplinary emergent field.

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**NBR: 254069** **ACRONYM: VLPSIRNA** **EC FUND: 237911**

**DG:** REA **Call: FP7-PEOPLE-2009-IOF** **Thema:** FP7-PEOPLE-2009-IOF

**Title:** Virus-like particles: the next step in gene therapy

**Abstract:** Virus–like protein particles can be applied as carriers for RNA gene therapy. The release of the RNA, however, is still a major problem. The goal of this proposal is to develop new routes towards the controlled opening of the virus capsid combining the cutting-edge science of bioconjugate chemistry and virology. This project intends to find a suitable carrier among non-infectious virus particles for small interfering RNA (siRNA) to be used for gene therapy. siRNA has the ability to specifically degrade RNA of a particular sequence and selectively stop the production of an abnormal undesired protein, which makes it a very promising therapeutic agent. The major obstacle, however, is to find an efficient method for cellular delivery of the RNA material. Virus-like particles, that are self-assembled protein cages, have the potential to be used as addressable carriers for siRNA. The Finn Group at the Scripps Research Institute has recently developed a method to produce virus-like particles that contain siRNA. The goal of the project is to engineer this particle, such that it successfully delivers the RNA into the targeted cell. This project will have the potential to make significant contributions to the fields of biomedicine and targeted drug delivery, strategically important areas identified by the European Technology Platform on Nanomedicine.

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**NBR: 254078** **ACRONYM: CLATHPOL** **EC FUND: 176065**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** Dynamic study of shape and force generation by clathrin polymerization onto lipid membranes in vitro.

**Abstract:** The “CLATHPOL” project focuses upon a fundamental aspect of Clathrin Coat Vesicle formation. The critical biochemical (clathrin/adaptor interactions, membrane composition) and physical parameters (deformation forces, role of pre-induced curvature) controlling the shape and polymerization rate of clathrin coats will be determined and the forces applied on the membrane by clathrin polymerization will be

measured. The “CLATHPOL” project will investigate the complex interactions driving clathrin coat assembly by developing improved bio-mimetic model systems to capture the complexity of biological membranes. The kinetics of clathrin polymerization and the dynamics of membrane shape generation will be studied by fast videomicroscopy using a membrane sheet assay to track coat formation on membranes exposed to various mixtures of clathrin and adaptor proteins. Membrane deformations will also be visualized using fluorescently labeled proteins. In the second stage, the forces on the membrane caused by clathrin polymerization will be measured using Giant Unilamellar Vesicles (GUVs). The membrane tension of the GUVs will be modulated by micropipette aspiration while membrane rigidity will be varied by changing lipid composition. Finally, the influence of membrane curvature on the dynamics and structure/geometry of the clathrin lattice will be determined using nano-patterned substrates with controllable and well-defined surface curvature. Membrane binding and lattice formation will be followed by Total internal reflection fluorescence (TIRF) microscopy and high speed atomic force microscopy.

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**NBR: 254125** **ACRONYM: D1SCO-FIL** **EC FUND: 166622**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** Disentanglement of the 1D electronic properties of Single-Walled Carbon Nanotubes via separation, co-doping and filling

**Abstract:** This project comprises a combined theoretical and experimental approach to engineer substitutionally doped and metallicity separated single walled carbon nanotubes with novel fillings with tailored electronic and optical properties. It aims at significantly advancing the limits of current capabilities that employ functionalized nanotubes with an option to underpin the research field in a short timescale. These predicted and engineered 1D structures act simultaneously as primed bulk n- or p- type material as host for novel fillings (fullerenes, metallocenes, and rare earth compounds) yielding also novel hybrid structures of a metallic core and a semiconducting host. The ultimate goal is a disentanglement of the interplay between charge transfer and hybridizations and bonding environment gaining sound information on the correlated 1D electronic and optical properties with unprecedented level using both the encaged compounds and heteroatoms as tracers. Optical, Raman and high energy spectroscopies and contemporary ab-initio theoretical spectroscopy will be used as a key to analyse these tailor made modifications and the influence of doping, and chemical interactions on the ground and excited state and the electronic transport properties. The final outcome will give a detailed assessment of the application potential in nanooptics and nanomechanics. This project has a highly interdisciplinary nature relying on three different research areas, based on the outstanding candidate’s experience in heteronanotubes, the worldwide renowned spectroscopic expertise of the host and the world-class expertise in theoretical spectroscopy of the training cooperation partner.

This project will allow the candidate to strengthen a well established intra-european collaboration and to greatly broaden her scientific background, making of her one of the most highly recognized scientist in her field. This will boost her career to the next scientific level.

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**NBR: 254238** **ACRONYM: MIPC** **EC FUND: 181103**

**DG:** REA **Call: FP7-PEOPLE-2009-IIF** **Thema:** FP7-PEOPLE-2009-IIF

**Title:** Microsphere Based Cellular Manipulation â€“ From Protein Delivery to Intracellular Palladium Catalysis

**Abstract:** The broad aims of this research project are the application, exploitation and development of a generic microsphere cellular delivery system that will allow the delivery of a broad range of cargos into cells. This microspehere based technology will enable the efficient deliver of benign, large nano-small micron-sized particles and their associated cargos into cells. Controlled release from these carriers of their associated cargos, into mammalian cells will allows a variety of cellular processes to be modulated and followed in real time, while providing a means of tagging and tracking cells in an in vivo environment. These microspheres have, quite remarkably, been demonstrated to allow the delivery of specific chemical reagents into cells. I will exploit the delivery of palladium based catalysts into cells to carryout a range of quite unique cell based transformations!

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**NBR: 254337** **ACRONYM: EMM3** **EC FUND: 250392**

**DG:** REA **Call: FP7-PEOPLE-2009-IOF** **Thema:** FP7-PEOPLE-2009-IOF

**Title:** Emerging Materials and Methods for 3rd generation solar cells

**Abstract:** Third generation solar cells represent alternatives to traditional bulk and thin film devices. They constitute a novel way to improve the ratio between photovoltaic efficiency and total cost, by including new physical principles and materials. This proposal combines two complementary aspects of third generation solar cells: new materials and new materials combinations and new physical mechanisms for photovoltaic conversion. The initial phase of the proposed research is mainly material characterization oriented: (i) Study of the combination of materials –such as InGaN, InN superlattices- which can lead to the formation of intermediate bands through the implementatuion of nanofrabrication technologies (ii) combination of optical spectroscopy and electronic transport techniques for the study of physical phenomena such as up/down conversion and intermediate band formation. In a second phase, the

initial results and methodologies will be combined with the know-how within the host institutions through close collaborations, and the research will evolve towards the realization of photovoltaic devices based on nanostructured material.

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**NBR: 254349** **ACRONYM: NEWQDS** **EC FUND: 241289**

**DG:** REA **Call: FP7-PEOPLE-2009-IIF** **Thema:** FP7-PEOPLE-2009-IIF

**Title:** New Frontiers in Quantum Dots Science: Assembly and Functionalisation

**Abstract:** This project will investigate a diverse range of octanuclear zinc sulfide nanoclusters as Quantum Dots (QDs). Compared with colloidal QDs whose distribution are random over space, these stoichiometric crystalline nanoclusters exhibit uniform cluster size and long-range periodic ordering which are vital for the study of quantum confinement effects. A simple and successful scheme to assemble them has been reported by the applicant and the goal of this project is to further assemble and functionalize this system, explore their fascinating optical properties and create a new research frontier in biological applications.

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**NBR: 254498** **ACRONYM: PLASBIORES** **EC FUND: 267173**

**DG:** REA **Call: FP7-PEOPLE-2009-IOF** **Thema:** FP7-PEOPLE-2009-IOF

**Title:** Plasmonic Biosensors based on nanometric optical Resonators integrated with point-light-sources for label free detection of DNA

**Abstract:** The objective of this project is to study the confinement of light in nanometric apertures in a metal film, the change of the transmission properties for very small changes in the refractive index inside the holes, and the subsequent development and fabrication of a device that serves to visualize singe DNA molecules, stretched in a channel and assembled into the nanohles, withouth fluorescent markers. For this, during the first stage (2 years in Berkeley), the fellow will study theoretically the system, will fabricate the devices, and study the transmission of light trhough single nanometric holes using the capabilities of the host group for optical characterization of nanostructures. Then, the sensitivity to the presence of DNA will be evaluated, by measuring the changes after specific hybridization inside the holes. The introduction of single nanoparticles (fluorescent or metallic) in the holes will be studied. During the reintegration stage (1 year in Copenhagen), the fellow will integrate the structures as part of a micro/nano fluidic device, for stretching and assembling of DNA single molecules into the pits, and develope the methodology to measure the change in the transmission trough the holes (when filled) to enable lable free visualization of the strands.

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**NBR: 254503** **ACRONYM: SURFACE ENDOCYTOSIS** **EC FUND: 162661**

**DG:** REA **Call: FP7-PEOPLE-2009-IIF** **Thema:** FP7-PEOPLE-2009-IIF

**Title:** Effect of nano-patterned substrate properties on cell attachment and endocytosis

**Abstract:** Cell-substrate interactions have a pronounced effect on cell attachment, growth and proliferation in healthy tissues and disease. The complexity of the in vivo setting has fueled in vitro studies on different aspects of cell behavior in response to different material properties. The proposed research project aims at establishing links between substrate properties and the fundamental process of endocytosis, on which limited knowledge currently exists. The use of mechanically and chemically defined, nano-patterned surfaces to probe the cellular mechanisms of regulation of different internalization pathways will be achieved through use of specialized cargoes, fluorescent labeling and imaging techniques. Strong emphasis will be placed on cancer cells, where both derailed endocytosis and abnormal extracellular matrix contribute to the disease. The combination of the researcher's strong background on endocytosis of nano structures and the host laboratory's expertise on surface fabrication and cell-surface interactions guarantee implementation of the project. The anticipated results will have a pronounced impact on our understanding of this fundamental cell process and are likely to be of technological interest in the fields of drug delivery and tissue engineering in the near future.

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**NBR: 254573** **ACRONYM: DNA-DAR** **EC FUND: 207629**

**DG:** REA **Call: FP7-PEOPLE-2009-IIF** **Thema:** FP7-PEOPLE-2009-IIF

**Title:** DNA sensor in polymer photonic crystal band-edge lasers with integrated nanochannels

**Abstract:** The proposed project will develop a polymer-based optofluidic lab-on-a-chip device to study the physical dynamics of label-free DNA molecules. DNA contains the complete genetic code of an organism, yet it is the interaction of DNA with other molecular species that determine how that code is interpreted. Moreover, it has been suggested that there are other factors beyond the genomic sequence that are involved in an organism's complexity. Subsequently, this project will study the physical dynamics of DNA by spatially profiling its restriction and extension attributes as it propagates along integrated nanochannels. The operating principle of the device will be based on the refractive index (RI) perturbation caused by a DNA molecule as it passes through an optical detector region. The optical detection scheme will use band-edge lasers in photonic crystals to monitor subtle shifts in wavelength caused by the change in RI. This

will result in a label-free approach to characterise DNA, circumventing the negative effects of dye staining – a common DNA investigation technique – that prevents true measurements of the molecule's behaviour. The device material will be polymer-based, offering an affordable development trajectory via nanoimprint technology. In addition, polymer is a suitable material for introducing active dopants, such as fluorescent dyes, to generate the photonic crystal band-edge laser components. Finally, the integration of nanochannels to the devices offers several novel advantages: the nanochannel provides a straightforward approach to deliver DNA to the detector regions; the nanochannel confines DNA, causing an extension of its molecular conformation and allowing access to structural detail otherwise difficult to obtain; and the nanochannel dimensions provide an opportunity to form slot waveguides, a mechanism that drastically increases optical mode intensities within narrow channels to significantly improve detection sensitivity.

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**NBR: 254575** **ACRONYM: CYANOBAC-RESPIRATION** **EC FUND: 179603**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** Organization and Dynamics of Respiratory Electron Transport Complexes in Cyanobacteria

**Abstract:** Photosynthesis and respiration are two of the most important biological processes on Earth for energy supply. Cyanobacteria can perform both oxygenic photosynthesis and aerobic respiration in thylakoid membrane. However, compared to extensively studied photosynthesis, knowledge of respiration is not satisfactory. So far, the long-range organization and mobility of respiratory complexes have never been investigated, and how photosynthesis and respiration are regulated in vivo is unknown. This project aims to determine the spatial distribution and mobility of respiratory systems in cyanobacteria, and to elucidate the interaction and regulation of respiratory and photosynthetic electron transport chains in thylakoid membrane. The first aim is to construct cyanobacterial strains containing respiratory complexes tagged with GFP and mCherry. Then high-resolution fluorescence confocal microscopy and fluorescence recovery after photobleaching allow to study the distribution and mobility of fluorescently tagged respiratory complexes and naturally florescent photosynthetic proteins. To supplement the fluorescence observations, using electron microscopy and scanning probe microscopy, this project will further examine the supramolecular organization of photosynthetic and respiratory complexes in thylakoid membrane at the molecular level. Based on the in vivo and in vitro findings, it is possible to draw a picture of the large-scale distribution of respiratory and photosynthetic complexes in vivo at the level of individual complexes, and to explore the coordination and regulation between photosynthesis and respiration. Advanced understanding of the bioenergetic pathways will practically benefit biofuel and biodiesel engineering, to exploit and improve renewable energy production by controlling the complex pathways of electron transport

in photosynthetic organisms. The interest of the interdisciplinary project covers molecular biology, biochemistry, biophysics and nanotechnology.

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**NBR: 254810** **ACRONYM: CESADIC** **EC FUND: 240289**

**DG:** REA **Call: FP7-PEOPLE-2009-IIF** **Thema:** FP7-PEOPLE-2009-IIF

**Title:** Crystal Engineering of Self-Assembled Diblock Copolymers with a Crystalline Core-Forming Block

**Abstract:** A series of complex, hierarchical micelle architectures such as block co-micelles have recently been prepared from crystalline-b-amorphous diblock copolymers using living, crystallization-driven polymerizations in solution. In this proposal the fundamental issues behind this novel process will be investigated. We propose to perform and interpret detailed experiments designed to allow us to understand the issues arising from the formation and behaviour of micelle architectures such as cylinders formed by diblock copolymers with a crystalline, core-forming polyferrocenylsilane block. The proposed studies of cylindrical micelles with a crystalline metallopolymer core will allow us to accumulate new fundamental knowledge in the field of polymer crystallization that can be used for predicting the behaviour of other crystalline blocks. For example, we will explore the extension to polylactide block copolymer materials. A variety of future applications in polymer and materials science and nanoscience are anticipated. This interdisciplinary and multidisciplinary research proposal requires a wide range of skills and combines the expertise of the applicant (polymer crystallization and morphology) with that of the host laboratory (polymer chemistry, materials chemistry, and nanoscience). The proposed research will bring a promising young researcher to the UK for 2 years before his return to Taiwan.

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**NBR: 254866** **ACRONYM: NANOREACTOR** **EC FUND: 173240**

**DG:** REA **Call: FP7-PEOPLE-2009-IIF** **Thema:** FP7-PEOPLE-2009-IIF

**Title:** Engineering a bacterial toxin alpha-hemolysin with Vitamin B12: Single Molceule Catalysis in the alpha-hemolysin nanoreactor

**Abstract:** This proposal describes a novel strategy for the embedding of vitamin B12 into a nano-sized protein reactor, in order to study the mechanism of reductive dechlorination reactions. This work will be the first study to observe catalysis in the alpha-hemolysin nanoreactor and will pave the way to the design of new biologically friendly catalysts for the degradation of harmful poly-chlorinated pollutants. In the experimental apparatus, preformed pores, (Staphyloccocal alpha-hemolysin) will be introduced into planar

bilayers by adding small amounts of the pore protein to one chamber. Reactions are monitored by recording the modulation of the ionic current that flows through an individual pore at a fixed applied potential in millisecond time scale. The observation of catalysis in the engineered pores is our aim to provide new opportunities to examine mechanistic steps that might be missed in ensemble measurements by known techniques. We propose to insert super reduced vitamin B12 (cyanocobalamin) into alpha-hemolysin pore under anaerobic conditions. This will yield a functional nanoreactor, which can be considered as a biosensor, to detect very small amounts of contamination of chlorinated waste molecules in the environment, as well as serve as a platform for single molecule studies. These experiments will shed light into the proposed reaction mechanism on reductive dechlorination of poly-chlorinated ethenes at a molecular level of detail. Understanding the steps of the carcinogenic vinyl chloride; VC formation will provide the knowledge to construct environmental friendly, “cell free” catalysts to prevent the accumulation of these carcinogens in the environment.

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**NBR: 254955** **ACRONYM: SMART** **EC FUND: 180669**

**DG:** REA **Call: FP7-PEOPLE-2009-IIF** **Thema:** FP7-PEOPLE-2009-IIF

**Title:** Stimuli-responsive Zipper-like Nanobioreactors

**Abstract:** The current nanobioreactor research is focussed on the fabrication of simple-to-use, inexpensive and ultra-sensitive devices which are highly selective, sensitive and stable. Thus, the fundamental goal of this research project is to design, develop and verify a novel bioreactor with self-control abilities for advanced applications (e.g. switchable bio-catalysis) utilising nanotechnology. This subject will be exploited by developing stimuli-responsive nanomaterials to construct zipper-like nanobioreactors, which could bring more attractive advantages: (i) ease of preparation; (ii) auto-switchable structure in contact with external stimuli; (iii) fast responsive/sensing time; (iv) high selectivity and sensitivity; (v) excellent storage stability; and (vi) cost-effectiveness.

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**NBR: 254957** **ACRONYM: NANOEYE** **EC FUND: 240289**

**DG:** REA **Call: FP7-PEOPLE-2009-IIF** **Thema:** FP7-PEOPLE-2009-IIF

**Title:** Optical Fiber-based Nanobiosensors for Early Prostate Cancer Diagnosis

**Abstract:** This project intends to construct novel nanosized optical fiber-based biosensors which could be applied to detect and monitor the existing telomerase in nucleus of single living cells without significantly altering and/or destructing single cell’s intracellular architecture and physiological function. By studying the level of telomerase in single

living cells, early-stage cancer could be detected and diagnosed. This project further aims to develop novel strategies for silver coating and biomolecules immobilisation on optical fiber-based nanoprobes.

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**NBR: 254974** **ACRONYM: TASMANIA** **EC FUND: 172403**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** TheoreticAl Study of MoleculAr Spin PlAsmonics for Nanoscale CommunIcAtions

**Abstract:** Communication networks and molecular plasmonics are two scientific disciplines, which at first sight might seem completely unrelated but which are about to meet in the emerging fields of nano-networks and nano-communication. Currently networks on chips are still using electronics, which is limited by dissipation losses and low speed. Optics cannot be used on nanoscale because of the diffraction limit of light. Plasmonics on the other hand offers high speeds and can be confined in nanoscale waveguides. In order for it to be really applicable to nano-networks, active devices such as switches and repeaters have to be created. A promising path to explore in the search for active devices on the nanoscale is the coupling between molecules and plasmons. The project aims to study the coupling between archetypal optically active molecules, the metal phthalocyanines and surface plasmon polaritons. It will also look at the scattering of plasmons from molecules and their subsequent propagation in order to identify possible anisotropy, which would allow for the application of the molecules as a plasmonic switch. A preliminary theoretical study has given promising results in this direction. Thus, even though theoretical, the project could have important practical results. The third objective is even more audacious: it aims at looking for interactions between the molecular spin state and the surface plasmons. Such an interaction would constitute huge breakthrough and allow control of the plasmons on quantum level as well as single-shot readout of the molecular spin. Furthermore the project will allow the researcher to undertake an inter-disciplinary experience and establish her as an independent scientist. In this way she can fully utilize her multi-disciplinary, multi-sector background to contribute to the synergy of ICT and nano-technology, thereby increasing European competitiveness in the emerging fields of nano-networks and nano-communication.

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**NBR: 254979** **ACRONYM: GRNES** **EC FUND: 181103**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** Analysis of the gene regulatory network controlling ES cell identity

**Abstract:** Self-renewal of embryonic stem (ES) cells depends on the activity of a network of transcription factors at the centre of which lies the triumvirate of Nanog, Oct4 and Sox2 that bind together to a multitude of target genes to either activate or repress their expression. Nanog was initially isolated by the host laboratory on the basis that elevating its expression increased ES cell self-renewal efficiency. Surprisingly however, the host laboratory further demonstrated that ES cells continue to self-renew in the absence of Nanog, albeit with dramatically reduced efficiency. Moreover, Nanog is not expressed uniformly within the Oct4/Sox2-expressing undifferentiated population. Instead, ES cells fluctuate between a state in which Nanog protein levels are low or absent, associated with a poor self-renewal efficiency, and a state in which Nanog levels are high, associated with a high self-renewal efficiency. In order to shed light upon the means by which these fluctuations direct altered cellular functions, we propose a project with the specific aims of: (i) determining the gene expression profile in ES cells expressing distinct forms of Nanog, (ii) analysing the co-dependency of chromatin binding by Nanog, Oct4 and Sox2 at relevant target genes, and (iii) test the functional importance of the most relevant Nanog responsiveness genes.

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**NBR: 254996** **ACRONYM: OPTONANOMECH** **EC FUND: 234337**

**DG:** REA **Call: FP7-PEOPLE-2009-IOF** **Thema:** FP7-PEOPLE-2009-IOF

**Title:** Operation of Cavity Optomechanics in Fluids for Ultrasensitive Mass Detection

**Abstract:** In cavity nanomechanics, researchers are racing towards the mechanical quantum ground states, however, it remains unclear how these interesting system could be usable in real applications. This project proposes that the cavity nanomechanics could find important use in a broad range of applications in chemical and biological detection. The use of cavity nanomechanics as sensitive mass detection could potentially replace mass spectrometers in portable detection systems. These devices are light based force devices. They use recirculating light to enhance the interaction of light and mechanical structure achieving an improvement of orders of magnitude in the intrinsic sensitivity compared with the commonly used free-space interferometer. The high displacement sensitivity translates to high mass sensistivity if the devices are employed in a sensing environment. The nanomechanical component of the cavity optomechanics provide extremely high mass sensitivity in mass sensing due to their excellent combination of small mass, high frequency and high mechanical quality factor. Zeptogram mass sensing has been achieved at low temperature and in vacuum, however, the mass sensitivity in ambient air is much lower due to air damping. In this project, the active oscillation resulting from regenerative cavity back-action brings about a new concept for ultrasensitive mass detection. In contrast to passive resonators, these active oscillators do not require external ac stimulation and can be self-sustained. With the proposed resonator (2GHz), the theoretical mass sensitivity in vacuum is

predicted to be 10-24g, close to the mass of a H atom. Under ambient conditions, the practical sensitivity will be compromised by air damping of the mechanical oscillator, the readout noise of the device systems and the molecular dynamic noise. Nevertheless, previous analysis shows that mass sensitivity on the order of 10-21g is possible with the optomechanical oscillators

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**NBR: 255075** **ACRONYM: SM-TRANSCRIPTION** **EC FUND: 172740**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** A single-molecule view of initial transcription

**Abstract:** The overall objective of this project is to study the initial phase of gene-transcription – i.e., the transformation of genetic information from DNA to RNA – at the level of individual molecules. State-of-the-art single-molecule fluorescence spectroscopy will be used in combination with a nanoscale "spectroscopic ruler" (a method based on the phenomenon of fluorescence resonance energy transfer, also known as FRET) to capture the transient intermediates and conformational changes of RNA polymerase, the protein machine that orchestrates transcription. This analysis will complement the static snapshots of transcription complexes, which have been obtained using X-ray crystallography. Single-molecule fluorescence methods are well suited for real-time studies of initial transcription, since the available temporal resolution is sufficient for monitoring conformational changes during the addition of a single nucleotide to an RNA chain. The specific aims are to develop novel real-time assays for detecting promoter-DNA opening and promoter-escape in vitro; to use the in vitro assays for studying the effect of specific DNA sequences on promoter-proximal pausing and promoter escape; and to take the first steps towards developing similar single-molecule FRET assays that report on transcription in living bacterial cells. The proposed work will contribute to the understanding of initial transcription, providing insights applicable to the transcription systems of higher organisms such as humans. The proposed toolbox will also find extensive use in the study of other important protein-DNA interactions, both in vitro and in vivo.

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**NBR: 255129** **ACRONYM: GRAPH-CNTS-CAT** **EC FUND: 82124**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** Intercalated Graphene Carbon Nanotubes for Heterogeneous Catalysis

**Abstract:** The objective of this proposal is the synthesis of a new type of carbon-based catalyst for application in heterogeneous catalysis: defect free graphene as well as graphene oxide

will be produced and sandwiched with carbon nanotubes through layer-by-layer deposition and intercalation chemistry to yield novel pillared carbon nanotube-graphene structures. Using intercalation chemistry metal atoms and ions will be inserted into their pores to achieve high catalytic turnover and selectivity towards a substrate could lead to an innovative “green” technology for pollution control. These materials will be characterized by Raman and XPS spectroscopies. Structural/morphological studies will allow investigations from the long range (XRD) to the short range (SEM, TEM) and thus the study the pillared carbon nanotube-graphene structures on different scale lengths, from meso- to nano-scale, before and after metal intercalation. Their catalytic activity will be evaluated using simple hydrogenation reactions of olefins in gas and liquid phases. The fellow will enlarge her experience on materials in environmental physical chemistry. She will built on her work with natural oxides and clays, which involved (a)synthesis and characterization of materials (b)study of surface/interfacial physicochemical properties and (c)catalysis. In a multidisciplinary training based on a state-of -the art infrastructure and guided by a world specialist in carbon materials, she will acquire new knowledge on physical deposition and characterization techniques. She will strengthen her soft skills by training in project management, presentation techniques, grant writing and IP issues. By being inserted in the broad international network of collaborations of her host group she will be able to build up her own future set of connections. All together this project will give the fellow all the tools for fulfilling her dream of a successful independent future career in academic research.

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**NBR: 255262** **ACRONYM: PHAGE-BEADS** **EC FUND: 180603**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** Hydrogel-Phage Composite Materials and Droplet Microfluidics

**Abstract:** Virus particles are increasingly used as building blocks for composite materials. Surface modification of these biological nanoparticles can be accomplished by genetic engineering and offers the possibility to combine directed evolution of molecular function with the assembly of more complex materials and devices. Virus display systems, especially phage display, have been extensively used for evolving peptides and proteins capable of specific binding to a diverse range of biomacromolecules and inorganic materials. Recently life science approaches emerged using virus particles as substitute antibodies in diagnostic tools. To harvest the full potential in connecting virus display technology with materials, smart fluid handling approaches must be applied allowing to process high numbers of samples. This project is about combining droplet microfluidics, a technology dealing with monodisperse water in oil emulsion droplets, with phage display. The emulsion droplets represent isolated vessels with volumes in the pico- to nanoliter range and can be split, merged, incubated and sorted at high frequency. In addition, hydrogel matrixes will be applied. They serve as scaffold for phage immobilization and allow to transfer the sample from emulsion to an aqueous

phase while retaining compartimentalization. The resulting gel beads will be designed as such that proteins can diffuse freely while the phages are immobilized in the matrix. The concept will be applied for directed evolution of enzymes and the development of novel diagnostic tools.

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**NBR: 255490** **ACRONYM: NANOSOUND** **EC FUND: 241886**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** Wet deposition of silicon for electrochemical devices

**Abstract:** Nanotechnology is expected to become a driver of sustainable energy development and energy storage. The possible photovoltaic (PV), thermoelectric, electrochemical application of various nanostructures including carbon nanotubes, C60, semi-conductor quantum dots has been intensively investigated. In the latter case, CdSe, CdTe and PbS nanocrystals have been successfully integrated in PV cells whereas transition metal oxides and phosphates nanocrystals have proven to be more efficient than their bulk counterparts as electrode materials for Li-ion batteries. This breakthrough has been made possible by the use of solution phase routes to tailor the size, shape, surface state and self-assembly of the nanoparticles We propose to explore the sonoelectrochemical and plasma assisted deposition methods to directly coat selected substrates by silicon nanocrystals. Glass and stainless steel substrates will respectively be used to measure the optical properties (absorption coefficient and photoluminescence) of the films and to test the electrochemical performance as an anode for Li-ion battery. This method will then be extended to polymers and fibers.

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**NBR: 255515** **ACRONYM: FP7 TNT FUNCTION** **EC FUND: 204568**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** Towards the mechanism and function of tunneling nanotube (TNT)-dependent, intercellular exchange of cargo

**Abstract:** Tunneling nanotubes (TNTs), recently discovered thin membrane channels connecting distant cells, represent the underlying structure of a previously unrecognized type of cell-to-cell communication. To date, a growing number of cell types have been found to use TNTs for the intercellular exchange of diverse cargoes ranging from cytoplasmic signalling molecules such as calcium ions to small vesicles of endocytic origin. During the past year, pathogens such as the human immunodeficiency virus and prions were also found to spread TNT-dependently between cells. Given the emerging wide range of implications of TNTs in the field of biomedical research, it is important to first learn the

basic principles and mechanisms of TNT-dependent cell-to-cell interactions. I therefore propose to focus on three major questions: First, I will characterize the type of endocytic vesicles transiting through TNTs using flow cytometry and quantitative live cell imaging to monitor the transfer of endosomal markers (Rab GTPases) through TNTs. Secondly, using the same methodological approach, I will analyze which myosin motor(s) is (are) involved in the active transport of vesicles through TNTs. Third, by employing a proteomic screen assay, I aim at characterizing the entire set of proteins/signalling molecules transferred through TNTs.

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**NBR: 255605** **ACRONYM: GI-MRI** **EC FUND: 180470**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** Dynamic and multi-nuclear magnetic resonance imaging for the assessment of nutrient and drug delivery in the human gastrointestinal tract

**Abstract:** Understanding the function of the gastrointestinal (GI) tract and its relation to abdominal symptoms and digestion is of fundamental importance in clinical medicine. Existing techniques are not able to describe the integrated, regulated mechanism by which foods are digested and drugs are delivered to the bowel. It is for these reasons that the causes of abdominal symptoms often remain unclear and that oral therapies for systemic conditions complicated by GI dysfunction are ineffective. This project will develop and apply MRI technology to assess the flow, mixing and transit of nutrients and oral drugs through the GI tract. Dynamic 1H-MRI will provide a comprehensive assessment of GI function and be combined with novel 19F-MRI that follows the passage of GI contents. Results will be validated and extended by 13C breath testing. The primary objective is to develop multi-nuclear MRI for use in physiologic measurements of GI function (1H-MRI) and delivery of nutrients/drugs (19F-MRI). This includes the optimization of accelerated 3D 1H-MRI for detecting GI function in long bowel segments and 19F-MRI utilizing (nano-)capsules containing a stable fluorocarbon as an oral contrast agent. This technology will be applied in clinical studies of two important diseases to assess whether these developments provide novel insight into the mechanism of disease: (1) Diabetic Mellitus, to assess how gastroparesis leads to abnormal nutrient delivery and impaired glycaemic control. (2) Parkinson's Disease, to assess how gastric dysfunction affects the delivery and absorption of levodopa and its efficacy for treatment of tremor and rigidity. This project will maintain the leading position of European researchers in MRI assessment of GI function, a technology that is likely to enter clinical practice in the next years. It will increase knowledge about the identification and management of GI complications in DM and PD, chronic diseases that are stated priorities of the FP7 work program.

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**NBR: 255624** **ACRONYM: THECOSINT** **EC FUND: 165540**

**DG:** REA **Call: FP7-PEOPLE-2009-IEF** **Thema:** FP7-PEOPLE-2009-IEF

**Title:** Theory of Quantum Computation and Many-Body Simulation with Novel Quantum Technologies

**Abstract:** The recently emerged discipline of quantum information promises to have a profound impact on the information technologies that so deeply permeate our society. The search for an actual quantum information processor involves different physical systems, thus motivating an exciting interdisciplinary research ground. In this framework the present project will involve contributions from various branches of quantum science, with emphasis to cutting-edge quantum technologies in condensed matter and quantum optical systems. The project -besides enhancing the competence diversification of the candidate- is properly tailored for his scientific trajectory which, starting from investigations on quantum information and quantum optics, aims at progressively acquire expertise in the field of many-body systems. This, in turn, is expected to strongly support the candidate in attaining a leading independent position. Specifically, the main objective of the project is to investigate theoretically novel approaches to quantum simulators (QS) and quantum computation (QC) properly tailored for new quantum technologies. The two major quantum information paradigms will be considered: discrete and continuous variables. The first goal is to individuate the benefits offered by novel technologies such as circuitQED, microcavities, and nano-elecromechanical oscillators. Then these technologies will be exploited to find novel proposals for QS of strongly interacting many-body systems (both spin and bosonic systems). The presence of thermal noise will be addressed by using new ideas emerged in the field of quantum thermodynamics. Finally, the last goal is the search for new continuous variable schemes for QC. We will focus on measurement based QC, a new computation paradigm which exploits the synergies between quantum information and many-body systems. To face the drawbacks that historically affect continuous variable QC the benefits offered by the above mentioned technologies will be harnessed.

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**NBR: 255635** **ACRONYM: HY-REM** **EC FUND: 171240**

**DG:** REA **Call: FP7-PEOPLE-2009-IIF** **Thema:** FP7-PEOPLE-2009-IIF

**Title:** Metal-containing hybrid materials for water remediation from trace heavy metals

**Abstract:** Innovative approaches based on alloying of metals to remove mercury from drinking water will be developed. Gold and silver nanoparticles immobilized on the surface of silsesqioxane-hydride films deposited on silica-gel surfaces will be used as a novel adsorbent for trace mercury removal. Use of silsesquioxane-hydride as an additive for

producing cryogels allows for creation of novel clean up devices for trace mercury removal from various environmental media. Incorporation of iron oxide nanoparticles in pores of silica-gel increase the specificity of the sorbent to arsenic removal.

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**NBR: 255662** **ACRONYM: EPREXINA** **EC FUND: 228747**

**DG:** REA **Call: FP7-PEOPLE-2009-IIF** **Thema:** FP7-PEOPLE-2009-IIF

**Title:** Electron paramagnetic resonance as a probe for extended interfaces in nanomaterials

**Abstract:** Ferroelectric materials are considered for applications in telecom devices opera ting at high frequency such as phase shifters, antennas or resonators. With the increasing requirements for miniaturization and low cost electronics, the market is nowadays widely turned to agile components and there is in particular a strong competition for the search of new materials. The best candidates for such applications are ferroelectric (FE) materials. Their distinctive advantage among all other materials is that their dielectric permittivity may be tuned under the application of moderate electric field. Of particular interest for this project are nanosize materials based on the barium titanate: composites, thin films and multilayers. In all these materials charge defects are playing very important role and EPR as the most sensitive method for paramagnetic defects and their local environment will be used to detect such defects and their position in: i) core or shell; ii) film or substrate; iii) interfaces; iv) surfaces. The main aim of this project is to use long time close cooperation of physicists and materials scientists to develop new methodology in materials design based on EPR application for the new materials creation with properties of demand.

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**NBR: 255669** **ACRONYM: MRHELIMAG** **EC FUND: 45000**

**DG:** REA **Call: FP7-PEOPLE-2009-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Spin-Transport in inhomogeneous Ferromagnets

**Abstract:** It is the aim of this research project to carry out systematic studies of spin-dependent transport in heavy rare earth (RE) metals based multilayered nanostructures. These nanoscale heterostructures made of layered rare earth metals would combine in variety of ways species bearing different magnetic character, such as ferromagnetic and antiferromagnetic order, as well as magnetic layers with non magnetic spacers. There exists a substantial gap in the literature regarding magnetoresistance (MR) studies on rare earth nanostructures, which would be of general interest for basic knowledge to fill in. This way, of particular interest will be to perform MR experiments for current perpendicular to plane configuration in vertically nanostructured RE-based systems,

where the magnetic RE slabs show helical antiferromagnetic (AFM) order. For these structures, there exist recent investigations that clearly point to the breaking of the chiral symmetry at the interfaces. This chiral asymmetry in helical AFM is likely to lead to much striking effects in the magneto-transport phenomenology of such so far unexplored nanostructures that we now coin as the so-called anisotropic chiral magnetoresistance in analogy to the already proposed electrical magnetochiral anisotropy in chiral conductors. A second topic that will very much focus our attention is the study of magneto transport in multilayered nanostructures of rare earth metals that would combine ferromagnetic, helical AFM and non-magnetic layers. These studies will look to test recent theoretical predictions that forecast a significant enhancement for the overall performance of such nanostructures, which includes nanostructured slabs with helical magnetic order that bear a spin spiral density wave, for current-driven spin-torque transfer effect devices with nanotechnology applications in the field of microwave oscillator systems for high-frequency communication technology.

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**NBR: 256281** **ACRONYM: PCM** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2009-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Time-Domain Measurements of Phase Change Memory Switching Characteristics and Investigation of the Drift Mechanisms for the Threshold Voltage and Reset Resistance Values

**Abstract:** In phase change memory devices based on amorphous semiconductor GeSbTe compounds, the switching is achieved through application of current pulses with various pulse widths and trailing edges. When the device is in the low resistance polycrystalline state (set-state) the application of a high amplitude current pulse can increase the local temperature above the melting point and if the trailing edge is short enough the molten state is quenched into an amorphous phase (high resistance-reset state) after the pulse is turned off. Above a threshold dc voltage the amorphous state becomes more conductive, allowing high enough currents to flow and induce spontaneous crystallization due to joule heating. This way the device switches back to its low resistance-set state. In this project the stability of the switching parameters (threshold voltage and reset resistance) in time will be studied using radio frequency (RF) probes and a time domain sampling oscilloscope. Performed measurements on the already fabricated samples of Ge2Sb2Te5 nanopillars with circular or rectangular cross-sections down to 50 nm in diameter will elucidate the role of nano-scale current distribution in the overall drift characteristics. Further measurements at elevated temperatures will reveal the relative contributions from thermally accelerated structural relaxations and electronic relaxation mechanisms. In our study, we will gain a much better understanding of the nature of the drift properties of the switching parameters and therefore we will contribute to the solution and control of one of the most important

problems in the practical applications of phase change memory, one of the most important memory devices that nanotechnology has produced as of today.

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**NBR: 256283** **ACRONYM: PHOTOBIO23JC** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2009-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** SYNTHESIS OF NOVEL NANOSTRUCTURED METAL-SUPPORTED PHOTOCATALYSTS: CHARACTERIZATION AND PROMISING APPLICATIONS IN THE PRODUCTION OF HIGH VALUE CHEMICALS FROM LIGNOCELLULOSIC BIOMASS

**Abstract:** Heterogeneous photocatalysis offers a lot of possibilities to find the appropiate environmental friendly solutions for the problems affecting our society among them the energy´s problems. Researchers are still looking for a new routes to synthetize solid photocatalysts which will be able to transform more efficiently solar energy into chemical energy. In many developing countries, biomass is still a major energy source. The Roadmap for Biomass Technologies, authored by 26 leading experts from academia, industry, and government agencies, has predicted a gradual shift back to a carbohydrate-based economy. Biomass and biofuels appear to hold the key for satisfying the basic needs of our societies for the sustainable production of liquid fuels and chemicals without compromising the needs of future generations. In this research, I will work on novel routes of preparation of metal-nanostructured photocatalysts. The novelity of these methods of synthesis are based on the anchoring of metals such as Fe, Cr, Ti, Pd, Pt by the application of ultrasonic and photo-ultrasonic irradiation to obtain metal-nanostructured materials with specific properties. USY-Zeolite with high Si/Al molar ratio and Fumed-SiO2 will be used as carriers. Those carriers have interesting textural properties which are very helpful in hetero-photocatalysis and have not been yet broadly investigated. I will provide a complete characterization of all synthesized photocatalysts using a wide range of physico-chemical techniques (XRD, XPS, UV-vis, chemisorption, among others) and explore the potencial application in the specific example of selective conversion of glucose/xylose (model compounds of lignocellulosic biomass structure) to high value chemicals.

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**NBR: 256297** **ACRONYM: NANOTUBE ENERGY** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2009-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Carbon nanotube structures as innovative electrode materials for more efficient energy storage devices

**Abstract:** Efficient capture, storage, and controlled release of energy are major global challenges for the twenty-first century. Dramatic improvement in the performance of energy storage & conversion devices is needed to meet future energy demands of our society, mainly in electrical propulsion (full electric vehicle) and to overcome the inevitable future shortage in fossil fuels, especially in gasoline. By combining Professor Aurbach (Bar Ilan University) expertise of electrochemistry, especially of Li and Mg, with Dr. Gilbert Nessim (MIT) capabilities in synthesizing dense arrays of crystalline carbon nanotubes (CNTs) on metallic layers, we propose to investigate the development of more efficient batteries that use composite metal-CNTs as electrodes. The main novelty of our approach is to use functionalized carbon structures on various nanotube electrode materials to improve ion insertion and storage, safety, and performance of Li ion based batteries in ionic liquid and in electrolyte solution with wide electrochemical window. The technical plan includes the investigation of multiple electrode materials and geometries upon which CNTs will be grown and functionalized to optimize electrode performance and cycling. Additional aspects of this project include applying the techniques and materials developed to lead acid batteries and to design more efficient supercapacitors. Extensive collaboration with MIT and with other academic and industrial institutions in Europe and the USA is a key aspect of this multi-disciplinary project. The goal of the project is to reintegrate Dr. Nessim at Bar Ilan as a faculty in the department of chemistry.

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**NBR: 256348** **ACRONYM: NANO-PROX** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2009-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Nano-Scale Protective Oxide Films for Semiconductor Applications & Beyond

**Abstract:** Conventional demands for development in semiconductor industry are changing as the Moore's Law approaching to its limits. Continuous decrease in the size of the transistors is coming close to atomic levels creating a fundamental barrier for further process developments as the semiconductor manufacturing is established today . Growth of thin films and inherent stress development within the film and film/substrate interface are critical for multiple phases of microelectronics manufacturing. Particularly, protective oxides of metal films are foreseen to have wide applications as (i) an interfacial layer to improve the adhesion and/or limit penetration of reactive chemicals of a deposited film (ii) as a subtractive layer to achieve selective material removal and (iii) as a nanofilm with inherent self growth limiting capability that could be used for nanoscale electronics manufacturing. Fundamental understanding of the proposed research is expected to be utilized in many other fields such as in biological systems to improve corrosion on bio-implants and, applications in which the interface and thin film properties affect permeation of reactive chemicals such as fusion reactor design or as ferroelectric capacitors where hydrogen permeation detoriates device functionality. Dr. Basim, the Principal Investigator of this study has been actively involved in semiconductor research

and development for more than ten years at major semiconductor companies in US. Her expertise is on integration of newly adapted semiconductor processes, defect reduction during manufacturing and chemical and mechanical interactions on thin films. She will initiate her research at Ozyegin University, Mechanical Engineering Department with the support of the IRG funds if awarded. Dr. Basim's new appointment at Ozyegin University is expected to bring all these expertise and experience to E.U. to promote the ongoing research and development.

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**NBR: 256392** **ACRONYM: HYBRID NANOMATERIALS** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2009-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Development of Hybrid Nanostructures for Photocatalysis and Fuel Cell Applications

**Abstract:** The goal of this study is two-folds: first to develop a new class of catalytic nanostructures based on semiconductor-metal hybrid composites and then to optimize their performance as fuel cell electrocatalysts. Presently, the commercial use of fuel cells is not yet viable due to the inefficiency of the required four electron reduction of adsorbed oxygen species at the cell cathode. This deficiency poses a fundamental challenge to the commercialization of fuel cell technologies. Several electrocatalytic metals have been employed to facilitate this oxygen reduction reaction (ORR), with platinum and platinum based alloys exhibiting the highest catalytic activity. Despite the use of platinum catalysts, the electron-transfer kinetics at the fuel cell cathode is still languid. In addition, platinum is an expensive precious metal, therefore, to achieve large-scale development and commercialization of fuel cells, it is essential that an alternative catalytic material is manufactured. To address this issue, we propose to design a novel catalytic structure which is comprised of a metal anchored onto a semiconductor body. This semiconductor-metal composite structure will take advantage of the intrinsic electron-transfer mechanisms within semiconductors and couple that with the catalytic activity of metals, yielding an electrocatalyst which provides excellent catalytic performance and cost-effectiveness. Fundamentally, this work will broaden our understanding of various essential parameters, such as material composition (the semiconductor and the metal), electron-transfer dynamics (i.e., electrochemical, photochemical), morphology of the nanostrucutres, as well as crystallinity, which impact the performance of an electrocatalyst. Such a fundamental framework is critical in the optimization of catalytic activity and thus will provide invaluable insights which will benefit the development of fuel cell technology.

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**NBR: 256428** **ACRONYM: NANOWEB** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2009-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Development of Functional Nanofibers by Electrospinning

**Abstract:** Electrospinning is a technique for producing nanofibers by creating a continuous filament by exposing a polymer solution or polymer melt to very high electrical fields. Due to its versatility and cost effectiveness, electrospinning has gained wide use recently to produce functional nanofibers from different materials, which include polymers, polymer blends, ceramics, sol-gels and composite solutions. Electrospun nanofibers and their nanowebs have several remarkable characteristics such as very large surface-to-volume ratio, pore sizes in nano range, unique physical properties along with the design flexibility for chemical/physical functionalization by incorporating specific additives into nanofibers. The unique properties and specific functionalities of such nanofibers/nanowebs make them favorable candidates in many applications areas such as medical/biotechnology, filtration and membrane technology, functional textiles, sensors, energy, composite materials, etc. Nanofibers/nanowebs from various types of natural and synthetic polymers can be easily produced by electrospinning, yet, improvements and new functionalities are always desired in order to enhance the properties of these electrospun nanofibers/nanowebs and broaden their application areas. Herein, it is proposed to fabricate functional polymeric nanofibers/nanowebs containing specific additives (cyclodextrins, textile additives, antibacterials, etc) by using electrospinning technique. The aim of this project is to produce new functional electrospun nanofibers/nanowebs and investigate their properties for the development of multi-functional nanofibrous materials for applications in filtration, functional textiles, medical/biotechnology, etc. The research proposed here has an interdisciplinary nature in the field of chemistry, materials science, textile, biology and engineering.

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**NBR: 256431** **ACRONYM: AP-GAC** **EC FUND: 45000**

**DG:** REA **Call: FP7-PEOPLE-2009-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** SYNTHESIS AND SELF-ASSEMBLY OF POLYPHOSPHAZENE (PP) BLOCK COPOLYMERS. DESIGN OF NEW INORGANIC NANOSTRUCTURES DERIVED FROM HIGH CRISTALLINE OR/AND CHIRAL HIGH TUNABLE PP BLOCK

**Abstract:** An exciting new area would involve PP block copolymers. These materials would possess an inorganic PP coblock which is superficially reminiscent of Polysiloxane. However, the PP block is inherently much more tunable. A key advantage is that whereas siloxane blocks are intrinsically highly hydrophobic, phosphazene blocks can be easily derivatized to allow them to become hydrophilic. This has the key advantage that self-assembly can be performed in water making processing and practical applications more realistic. This tunability of phosphazene blocks, will allow us to gain deep insight into the factors that facilitate self-assembly of block copolymers in solution and will also allow us to access

stabilized nanomaterials for example by introducing crosslinking groups. The introduction of high crystallinity and/or chirality in the PP block will allow us to generate novel and interesting nanostructures.

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**NBR: 256465** **ACRONYM: QNAO** **EC FUND: 45000**

**DG:** REA **Call: FP7-PEOPLE-2009-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Quantum Nano Optomechanics

**Abstract:** The applicant has been recruited as a Chargé de Recherche for CNRS and will start soon at the Institut Néel (Grenoble, France) his own research activities. The Marie Curie Reintegration Grant will help him start his independent research career and support his installation at the Institute. The goal of the project is to extend the thematic of cavity optomechanics down to the nanoscale and observe the quantum first signatures with hybrid systems constituted of nanomechanical oscillators and single emitters. From their higher mechanical susceptibility, nano-resonators can facilitate the access to the quantum regime of radiation pressure and allow observing the week coupling to a single emitter. Those systems are also interesting candidates for opening links towards solid state physics at the condition to be able to detect and control their Brownian motion. The project will consist in developing an ultrasensitive nearfield sensor of the nanomotion. To do so the nano-mechanical oscillator will be approached in the evanescent tail of a high-Q optical microcavity, rendering its optical resonances sensitive to its position fluctuation. This approach allows to overpass the diffraction limit inherent to the use of light fields with sub-wavelength objects, while still benefiting from the ultrasensitive readout capacity offered by low noise laser sources. Various kinds of exotic resonators could then be studied, in particular suspended graphene membranes, nanotubes, and micropilars or photonic crystal cavities embedding single emitters. The second part of the project aims at studying the coupling of a nano-resonator to a single emitter (quantum dots / color center in diamond nano-crystals), a system that can be seen as a macroscopic trapped ion, and observes the first quantum signatures of this hybrid quantum system.

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**NBR: 256498** **ACRONYM: BONEMIM** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2009-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** A Novel Biomimetic Bone-like Material

**Abstract:** Conventional orthopedic implants and dental filling approaches are only partly successful in preventing load-bearing failures and long-term durability, respectively. The

problem in the current materials for bone repair and regeneration is that none of them has the hierarchical structure of natural bone that incorporates inorganic crystals with organic molecules. Any long-lasting biomimetic bone-like material should be designed from a well-dispersed inorganic nanoparticle phase in an organic matrix. This work is going to accomplish the following objectives: 1) Development of organic/apatite hybrid biomaterials based on apatite nanoparticles dispersed in a polymer gel. 2) Determination of physicochemical factors affecting the self-assembly of the hybrid material. 3) Characterization of micro- and nano-structure of the hybrid material. 4) Evaluation of mechanical strength and interfacial characteristics of the self-assembled biomaterial. Micro-/nano-structural characterization of this new biohybrid material will be done by using several techniques to investigate material composition and morphology. The mechanical properties of the designed biomaterial will be tested. The outcomes of this research will provide a novel approach for bone regeneration and will serve as a basis for future in-vivo experiments with the long-term goal of repairing bone defects.

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**NBR: 256504** **ACRONYM: CELL POLARITY** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2009-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Role of Microtubule Polarity and Polarized Membrane Traffic in Directed Cell Migration

**Abstract:** The ability of cells to polarize is crucial for development, wound healing, and neurotransmission. As many cellular polarity factors play central roles in disease (e.g. cancer, neurological dysfunction) understanding the molecular basis of cell polarity is of great importance to the biomedical sciences. One central aspect of cell polarity involves the regulation of the cytoskeleton and membrane-trafficking machinery, leading to the delivery of specific proteins and lipids to distinct cellular subdomains. This polarized membrane traffic seems important for cells that exhibit local cell growth, including migrating cells. Using advanced imaging approaches I showed that migrating cells preferentially deliver their secretory vesicles towards the leading edge (i.e. the front), and that this polarized delivery depends on intact microtubules (MTs). But how MTs and polarized membrane traffic contribute to cell migration remains unclear. Recent work on wound-edge migrating cells has identified factors that lead to distinct MT polarity phenotypes, i.e. MT stabilization and centrosome orientation, both of which could contribute to bias membrane traffic towards the front of the cell by either forming specialized vesicular tracks or by positioning secretory organelles in front of the nucleus. I will use interdisciplinary cell biological and state-of-the-art imaging and screening approaches to 1) investigate the mechanism of how MT polarity and polarized membrane traffic contribute to directed migration using known factors, 2) identify membrane trafficking factors that play a role in directed migration using automated image-based screening and 3) investigate the role of common traffic/migration factors in polarized membrane traffic and MT polarity. Further, I will implement 'super-

resolution' microscopy to image the nanoscale localization of polarity factors in greater detail. These studies are aimed toward a more comprehensive understanding of cell polarity.

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**NBR: 256514** **ACRONYM: TNP-HGNS** **EC FUND: 75000**

**DG:** REA **Call: FP7-PEOPLE-2009-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Self-Assembled Thermo-NanoProbes on Hollow Gold Nanoparticles For Theragnostic Applications

**Abstract:** The functionally controllable molecules that are activated upon irradiation, have received a significant attention as nano-scale delivery tools in biomedical applications. Among these, photolabile caged therapeutic molecules are chemically blocked species which can be liberated in their active form by exposure to ultraviolet (UV) radiation. By precise tuning of UV source, the use of these photosensitive probes becomes a unique tool to treat a selected biological target spatially and temporally. This technique has been successfully employed in a variety of biological studies; however, it is mostly limited to in vitro applications. The restriction is mainly due to the destructive effects of UV light which has shallow tissue penetration with strong absorption. Quite the contrary, near-infrared (NIR) radiation is known to have deep tissue penetration with minimum absorption. This outstanding property of NIR, with the aid of strong NIR absorbers, can be utilized to trigger a mechanism in cells for therapeutic and diagnostic (theragnostic) purposes. Among other metal nanoparticles that have been extensively studied for such purposes, gold nanoparticles, such as hollow gold nanostructures (HGNs), emerge as ideal tools for these applications since they possess optical tunability, easy functionalization, inertness, non-toxic behavior, accumulation in tissues, and intense absorption of NIR light. During the NIR absorption process, the absorbed energy by HGNs will be transferred into thermal energy that consequently heats the surroundings. This NIR mediated heating process can be employed for thermal cleavage of chemical bonds within the molecules, so called "thermolabile caged compounds". This project proposes a novel design and synthesis of NIR driven thermolabile caged molecules as a nano-scale delivery tool, and their self-assembly on HGNs for targeted therapy and optical imaging applications.

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**NBR: 256571** **ACRONYM: ELIOT** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2009-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Electronic and Ionic Transport in Functional Oxides

**Abstract:** Two of the main drivers of worldwide economic growth and scientific development are the semiconductor/IC industry and the need for new energy resources. The need for alternate renewable sources of energy such as sunlight and wind power which are inherently discontinuous, poses new challenges for energy transport and storage. Although many of the materials used in the IC industry and in energy storage are similar, the research in their properties has been separated in two fields with very little interdisciplinary interaction. This proposal aims to cross this barrier and evaluate physical and electrical properties of transition metal oxides in their nanostructured form for non-volatile memory and energy storage applications. For this we will investigate how material production and physical properties influence electronic and ionic transport properties in these oxides. We propose to evaluate transition metal oxides, starting with simple binary oxides such as vanadium oxides and assess how material production and physical properties influence electrical and/or ionic transport properties. A first objective is to identify materials where resistive switching can be ascribed to correlated electron effects rather than oxygen or oxygen vacancy rearrangement. It is interesting to determine how these effects are influenced by size and confinement. This is done keeping in mind possible applications as switch/ memory elements. Some oxides are expected to show relatively high ionic mobility making them good candidates for alternate battery materials. For this, screening of ionic mobility of the intrinsic oxide and of Li in the oxide is to be investigated. Correlating oxygen mobility in the lattice with Li mobility can help better engineer materials for highly performing batteries.

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**NBR: 256580** **ACRONYM: MONINTERFLUOPROT** **EC FUND: 75000**

**DG:** REA **Call: FP7-PEOPLE-2009-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Monitoring of cell signaling pathways via interaction of fluorescently tagged proteins

**Abstract:** At present, fundamental questions in biomedical translational research require the use of non invasive nanometer resolution techniques that facilitate the study of cell structure and function in vivo. The proposed project is highly interdisciplinary: it encompasses advanced research techniques in biophysics, cell physiology, and molecular biology. The long term aim of the project is to establish a cutting-edge multidisciplinary program in biomedical and translational research at the Department of Biophysics at the P.J. Šafárik University in Košice, Slovakia. The foundation of this program is laid out within EU structural fund projects CEVA I and II and SEPO I and II. The applicant, Dr. Stroffekova has advanced knowledge of cell physiology and biophysics, and was therefore approached to participate in the design and planning of the infrastructure for above mentioned EU projects, and to carry on her further research at the Department of Biophysics. The specific objectives of the present project are to introduce new research methodologies that will be used within infrastructure and to expand the scientific potential at the Department of Biophysics. Specifically, the project will introduce and establish electrophysiological measurements by whole cell patch

clamp, site-directed mutagenesis and creation of fluorescent fusion proteins (FFPs) for application in confocal microscopy and fluorescence resonance energy transfer (FRET) measurements, and immunocytochemistry. All these methodologies will be used in novel approach to quantify the onset and modulation of apoptosis by FFPs, which will expand research capabilities for a molecule targeted photodynamic therapy in malignant cells. The proposed project and its funding will greatly improve applicant's abilities to establish a continuation and transfer of her research from USA to Slovakia, to introduce proposed methodologies in the Department of Biophysics, and to firmly anchor her long term career in Slovakia.

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**NBR: 256601** **ACRONYM: HPCAMO** **EC FUND: 45000**

**DG:** REA **Call: FP7-PEOPLE-2009-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** A new computational framework for molecular dynamics.

**Abstract:** We propose a project in the research field of the interaction of electromagnetic (EM) fields with complex atomic systems. Current and ongoing developments on sources of EM coherent radiation with super-intense peak power and/or ultra-short duration (of attosecond scale = 10-18 sec) at frequencies from the far infrared (fraction of eV) to hard X-rays (keV) makes the present proposal a timely and essential one. The theoretical framework applies to multi-electron quantum systems such as atoms and molecules, systems that is known to be of particular importance in cutting edge research areas such as nano-science, atomic and plasma physics as well as quantum chemistry. By drawing our expertise around a well defined subject, through a very successful theoretical approach, namely the R-matrix approach, this project is aimed to extent and implement a theoretical and computational method, developed by the applicant during his Marie-Curie Fellowship, to describe (ab-initio) the dynamics of molecular hydrogen under strong EM fields. To accomplish this objective, it will be indispensable to merge methods from quantum and computational physics, thus demanding development of numerical algorithms on high-performance architectures.

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**NBR: 256615** **ACRONYM: APOSTILLE** **EC FUND: 1050900**

**DG:** RTD **Call: FP7-REGPOT-2010-5** **Thema:** REGPOT-2009-2

**Title:** Reinforcement of Research Potentials of the Faculty of Technical Sciences in the Field of Post Silicon Electronics

**Abstract:** APOSTILLE Project is aimed to reinforce the research capacities and capabilities of the Faculty of Technical Sciences (FTS) in the field of nano and organic/flexible/printed

electronics. The Project applicant, FTS, Serbia is a vibrant research institution with long - lasting experience in international collaborative research projects. The Project team (40 researchers from 3 coherent groups) has strong expertise in: design of high-performance integrated microelectronics components; fabrication of microsensors and RFIDs; design&verification of embedded systems and robotics. Five objectives have been defined in the Action Plan: (1) increasing the knowledge base, skills and experience of the FTS Project team through trans-national two-way secondments between FTS and the strategic EU networking partners (DIEES - Italy, pmTUC – Germany, JSI - Slovenia, FESTO - Austria, LNESS - Italy and ISAS - Austria). This objective will be achieved through 7 two months stays and 30 short training visits as well as through the attendance at international conferences; (2) reinforcement of the human potential through hiring 3 incoming experienced researchers (Mirko Smiljanić, Nikola Jeranče and Slobodan Nedić) (3) purchase of new research equipment, (Materials deposition printer for organic/flexible electronic, Nanomanipulator and High-performance cluster computer); (4) knowledge exchange at national, WBC and international levels, through the organization of 2 workshops and 3 international conferences; (5) increased visibility of FTS excellence and Project results, through dissemination and promotional activities. This action plan will ensure APOSTILLE can deliver sustainable innovative research results and future research interactions at both WBC and European level. The ultimate goal of the Project is to prepare ground for R&D integration of FTS into FP7 and ERA.

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**NBR: 256639** **ACRONYM: DIAG-CANCER** **EC FUND: 1200000**

**DG:** ERCEA **Call: ERC-2010-StG_20091118** **Thema:** ERC-SG-LS7

**Title:** Diagnosis, Screening and Monitoring of Cancer Diseases via Exhaled Breath Using an Array of Nanosensors

**Abstract:** Cancer is rapidly becoming the greatest health hazard of our days. The most widespread cancers, are lung cancer (LC), breast cancer (BC), colorectal cancer (CC), and prostate cancer (PC). The impact of the various techniques used for diagnosis, screening and monitoring these cancers is either uncertain and/or inconvenient for the patients. This proposal aims to create a low-cost, easy-to-use and noninvasive screening method for LC, BC, CC, and PC based on breath testing with a novel nanosensors approach. With this in mind, we propose to: (a) modify an array of nanosensors based on Au nanoparticles for obtaining highly-sensitive detection levels of breath biomarkers of cancer; and (b) investigate the use of the developed array in a clinical study. Towards this end, we will collect suitable breath samples from patients and healthy controls in a clinical trial and test the feasibility of the device to detect LC, BC, CC, and PC, also in the presence of other diseases. We will then investigate possible ways to identify the stage of the disease, monitor the response to cancer treatment, and to identify cancer subtypes. Further, we propose that the device can be used for monitoring of cancer patients during and after treatment. The chemical nature of the cancer biomarkers will be

identified through spectrometry techniques. The proposed approach would be used outside specialist settings and could considerably lessen the burden on the health budgets, both through the low cost of the proposed all-inclusive cancer test, and through earlier and, hence, more cost-effective cancer treatment.

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**NBR: 256915** **ACRONYM: MB2** **EC FUND: 1485000**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-ID1

**Title:** Molecular Biomimetics and Magnets Biomineralization: Towards Swimming Nanorobots

**Abstract:** Nature not only provides inspiration for designing new materials but also teaches us how to use interparticle and external forces to structure and assemble these building blocks into functional entities. Magnetotactic bacteria and their chain of magnetosome represent a striking example of such an accomplishment where a simple living organism precisely tune the properties of inorganics that in turn guide the cell movement thereby providing an energetic advantage vs. the non-magnetotactic counterparts. In this project, we will develop a bio-inspired research based on magnetotactic bacteria. We will combine the recent developments of nanoscale engineering in the chemical science and the latest advances in molecular biology to create a novel methodology enabling first, the understanding of the control of biological determinants over single inorganic building blocks at the nanoscale and over highly-organized hierarchical structures, and second, the use of these biomacromolecules to construct new functional materials. We will use phage display to genetically select peptides specifically binding to magnetite and look for homology within the available genomes of the different strains of magnetotactic bacteria in order to detect promising biological determinants. We will screen the identified compounds by our in-house developed high-throughput technique based on force microscopy. On the one hand, the effect of the high potential biological determinant on the properties of magnetic nanoparticles will be tested under physiological conditions in biomimetic reactor. On the other hand, we will use the knowledge gained from the binding capacities of the peptides to functionalize magnetite nanoparticles and assemble them in order to eventually form a swimming nanorobots that can be directed by an external magnetic field while transporting beads.

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**NBR: 256959** **ACRONYM: NANOPOWER** **EC FUND: 2629277**

**DG:** CNECT **Call: FP7-ICT-2009-5** **Thema:** ICT-2009.8.6

**Title:** Nanoscale energy management for powering ICT devices

**Abstract:** Nanoscale energy management is a new, exciting field that is gaining increasing importance with the realization that a new generation of micro-to-nanoscale devices aimed at sensing, processing, actuating and communication will not be possible without solving the powering issue. The scientific objective of this project is thus to study energy efficiency with the specific aim of identifying new directions for energy-harvesting technologies at the nanometre and molecular scale. The technological objective of the project is to integrate such technologies into autonomous nanoscale systems to allow new, low-power ICT architectures to find their way into devices. In a joint effort, the nanopower consortium composed by world leading experts in the fabrication of Si and III-V semiconductor nanodevices, fundamental and applied modelling as well as design and integration of ICT architectures will fabricate, test and evaluate new conception devices: “nanomechanical nonlinear oscillators”, “phonon rectifiers” and “quantum harvesters” addressing applied prototypes and non-equilibrium processes down to the quantum level.

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**NBR: 256962** **ACRONYM: C3ENV** **EC FUND: 1500000**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE4

**Title:** Combinatorial Computational Chemistry A new field to tackle environmental problems

**Abstract:** Combinatorial Computational Chemistry is developed as a standard tool to tackle complex problems in chemistry and materials science. The method employs a series of state-of-the-art methods, ranging from empirical molecular mechanics to first principles calculations, as well as of mathematical (graph theoretical and combinatorial) methods. The process is similar as in experimental combinatorial chemistry: First, a large set of candidate structures is generated which is complete in the sense that the best possible structure for a particular purpose must be found among the set. This structure is then identified using computational chemistry. We will apply methodologies at different stages in hierarchical order and successively screen the set of candidate structures. Screening criteria are based on the computer simulations and include geometry, stability and properties of the candidate structures. Detailed characteristics of the final materials will be simulated, including the X-ray diffraction pattern, the electronic structure, and the target properties. We will apply C3 to two important problems of environmental science. (i) We will optimise nanoporous materials to act as molecular sieves to separate water from ethanol, an important task for the production of biofuels. Here, materials are optimised to transport ethanol, but not water (or vice versa). The tuning parameters are the channel size of the material and its polarity. (ii) We will optimise nanoporous materials to transport protons, an important task for the design of energy-efficient fuel cells, by distributing flexible functional groups, acting as hopping sites for the protons, in the framework.

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**NBR: 256965** **ACRONYM: NANO-GRAPHENE** **EC FUND: 1041240**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE3

**Title:** Understanding the Electronic Properties of Carbon Nanotubes and Graphene as Quantum Conductors

**Abstract:** In low-dimensional systems the strength of electronic interactions is enhanced, which can give rise to fascinating phenomena such as charge fractionalization, spin-charge separation and fractional or non-Abelian statistics. Furthermore, the effects of disorder and external factors (such as the substrate, the leads, magnetic fields, or the coupling with a gate or an STM tip), are much stronger in low-dimensional systems than in three-dimensional systems, and can greatly alter their properties. The first goal of this project is to find experimental signatures of the exotic phenomena caused by interactions, both in carbon nanotubes, and in regular and graphene fractional quantum Hall systems. The second goal is to understand how the interplay between disorder, interactions and external factors impacts the physics and the possible technological use of nanotubes and graphene in electronic nanodevices. To achieve these goals I intend to calculate theoretically quantities measurable by electronic transport, such as the conductance and the noise, in particular the noise at high-frequencies, as well as quantities measurable by scanning tunneling microscopy (STM), such as the local density of states (LDOS). Furthermore I intend to analyze and explain the recently developed STM experiments on graphene, and to propose new STM measurements that will elucidate the physics of graphene in the fractional quantum Hall regime. Some of the theoretical techniques that I plan to use are the perturbative non-equilibrium Keldysh formalism, conformal field theory and the Bethe ansatz, the T-matrix approximation, the Born approximation and numerical methods such as ab-initio and recursive Green's functions.

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**NBR: 257023** **ACRONYM: MICROBONE** **EC FUND: 1493399**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE8

**Title:** Multiscale poro-micromechanics of bone materials, with links to biology and medicine

**Abstract:** Modern computational engineering science allows for reliable design of the most breathtaking high-rise buildings, but it has hardly entered the fracture risk assessment of biological structures like bones. Is it only an engineering scientist's dream to decipher mathematically the origins and the evolution of the astonishingly varying mechanical properties of hierarchical biological materials? Not quite: By means of micromechanical theories, we could recently show in a quantitative fashion how "universal" elementary building blocks (being independent of tissue type, species, age, or anatomical location) govern the elastic properties of bone materials across the entire vertebrate kingdom,

from the super-molecular to the centimetre scale. Now is the time to drive forward these developments beyond elasticity, striving for scientific breakthroughs in multiscale bone strength. Through novel, experimentally validated micromechanical theories, we will aim at predicting tissue-specific inelastic properties of bone materials, from the "universal" mechanical properties of the nanoscaled elementary components (hydroxyapatite, collagen, water), their tissue-specific dosages, and the "universal" organizational patterns they build up. Moreover, we will extend cell population models of contemporary systems biology, towards biomineralization kinetics,in order to quantify evolutions of bone mass and composition in living organisms. When using these evolutions as input for the aforementioned micromechanics models, the latter will predict the mechanical implications of biological processes. This will open unprecedented avenues in bone disease therapies, including patient-specific bone fracture risk assessment relying on micromechanics-based Finite Element analyses.

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**NBR: 257051** **ACRONYM: EURODOTS** **EC FUND: 1185404**

**DG:** CNECT **Call: FP7-ICT-2009-5** **Thema:** ICT-2009.3.1

**Title:** European Doctoral Training Support in Micro/Nano-electronics

**Abstract:** This support action, EURO-DOTS, is aimed primarily at improving the offering and the quality of training proposed to European PhD students. It helps fulfilling the requirements for ECTS credits imposed to PhD students by major European universities for obtaining the Doctoral (PhD) degree in Engineering. A coherent set of advanced courses in micro/nano-electronics, explicitly accredited by major European universities in the framework of their Doctoral Program, will be made easily accessible to European PhD students, offering the opportunity to collect ECTS credits throughout Europe. The global objective of EURO-DOTS is to create a delocalized (virtual) platform to serve the Doctoral Schools in Europe in micro/nano-electronics. The courses will respect specific organization criteria (short, intensive one-week course modules with optional exam) that will make them very flexible, accessible and attractive as well for high-level continuous education of engineers from industry. Scholarships will be made available to selected PhD students for boosting the start-up of the project, while other sources of scholarships and/or industrial support will be explored for the long-term continuation of the project.

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**NBR: 257094** **ACRONYM: AUTO-EVO** **EC FUND: 1487827**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE3

**Title:** Autonomous DNA Evolution in a Molecule Trap

**Abstract:** How can we create molecular life in the lab? That is, can we drive evolvable DNA/RNA-machines under a simple nonequilibrium setting? We will trigger basic forms of autonomous Darwinian evolution by implementing replication, mutation and selection on the molecular level in a single micro-chamber? We will explore protein-free replication schemes to tackle the Eigen-Paradox of replication and translation under archaic nonequilibrium settings. The conditions mimic thermal gradients in porous rock near hydrothermal vents on the early earth. We are in a unique position to pursue these questions due to our previous inventions of convective replication, optothermal molecule traps and light driven microfluidics. Four interconnected strategies are pursued ranging from basic replication using tRNA-like hairpins, entropic cooling or UV degradation down to protein-based DNA evolution in a trap, all with biotechnological applications. The approach is risky, however very interesting physics and biology on the way. We will: (i) Replicate DNA with continuous, convective PCR in the selection of a thermal molecule trap (ii) Replicate sequences with metastable, tRNA-like hairpins exponentially (iii) Build DNA complexes by structure-selective trapping to replicate by entropic decay (iv) Drive replication by Laser-based UV degradation Both replication and trapping are exponential processes, yielding in combination a highly nonlinear dynamics. We proceed along publishable steps and implement highly efficient modes of continuous molecular evolution. As shown in the past, we will create biotechnological applications from basic scientific questions (see our NanoTemper Startup). The starting grant will allow us to compete with Jack Szostak who very recently picked up our approach [JACS 131, 9628 (2009)].

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**NBR: 257099** **ACRONYM: SELFCHEM** **EC FUND: 1494075**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE5

**Title:** Information Transfer through Self-organization Processes in Systems Chemistry

**Abstract:** Today, one of the greatest challenges facing physics, chemistry, and (bio)materials science, is to precisely design molecules so as to program their spontaneous bottom-up assembly into functional nano-objects and materials, based on recognition and self-organization processes. Beyond that, in order to reach higher-performing new materials and to bridge the gap between materials science and life science, it appears essential to bring together both multiple responsive levels of hierarchical organization and time-dependent processes. The objectives of the SelfChem research project are part of this bundle of explorations and thus lie within an area inquiry which encompasses a better understanding of complex systems, self-organization, and emergence of order from chaos. The main specificity and novelty of the SelfChem project is to focus on an issue that has not been approached to date, namely the possibility to transfer chemical or physical information, in space and time, through the self-induced organization of their

own supramolecular carriers. In other words, we wish to show that the circulation of information can be the driving force for the self-assembly of systems that will in turn serve to transfer this very information. The main axes of the proposal are three-fold and deal with: a) the duplication of chemical information towards several generations of bounded systems that couple small molecular self-replicators within self-replicating vesicles (reproduction); b) the transfer and conversion of chemical information between two compartments separated by a non permeable membrane (transduction); and c) the transport of physical information, i.e. electric charges, by the enforced self-organization of molecular wires between two electrodes (conduction). In addition to these fundamental investigations, we plan to use the knowledge produced for the design of smart, responsive, and adaptive (bio)materials.

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**NBR: 257111** **ACRONYM: SQWIRE** **EC FUND: 3150000**

**DG:** CNECT **Call: FP7-ICT-2009-5** **Thema:** ICT-2009.3.1

**Title:** Silicon Quantum Wire Transistors

**Abstract:** The aim of the SQWIRE project is to develop a disruptive, industry-compatible CMOS technology based on novel silicon nanowire transistor structures. The co-ordinator has demonstrated both theoretically and experimentally that nanowire MOS transistors can be fabricated at wafer level using silicon-on-insulator (SOI) substrates. These novel devices have shown electrical properties that are comparable or even superior to those of regular transistors. Two such novel devices are the Gated Resistor (a junctionless transistor simulated, prototype fabricated and patented) and the variable-barrier tunnel transistor (VBT, simulated and patented). To obtain industrial validation, fabrication routes will be developed for these devices on novel 300 mm SOI wafers with silicon film thicknesses of only 10 nm. These routes will be underpinned by process development targeting atom-scale control of the silicon film thickness across the wafer. Device performance will be characterised at die-level and evaluated in a statistically meaningful manner at wafer level. The extracted parameters will serve as the basis for the development of a compact model of the Gated Resistor devices, which can be used for further circuit design and the validation of advanced numerical simulations. The fabrication process for the first device (Gated Resistor) is less complex and more flexible than that of regular transistors. It has the potential of increasing yield and reducing the price of integrated circuits. Furthermore, the Gated Resistor offers the promise of superior scaling to sub-22 nm dimensions compared to regular transistors. In addition, the process can easily be implemented in semiconductor materials other than silicon. The second device (Variable Barrier Transistor) is capable of providing subthreshold slopes sharper than any conventional transistor. This permits one to reduce the supply voltage of integrated circuits, and hence their energy consumption.

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**NBR: 257158** **ACRONYM: ACTIVENP** **EC FUND: 1494756**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE3

**Title:** Active and low loss nano photonics (ActiveNP)

**Abstract:** This project aims at designing novel hybrid nanophotonic devices comprising metallic nanostructures and active elements such as dye molecules or colloidal quantum dots. Three core objectives, each going far beyond the state of the art, shall be tackled: (i) Metamaterials containing gain materials: Metamaterials introduce magnetism to the optical frequency range and hold promise to create entirely novel devices for light manipulation. Since present day metamaterials are extremely absorptive, it is of utmost importance to fight losses. The ground-breaking approach of this proposal is to incorporate fluorescing species into the nanoscale metallic metastructures in order to compensate losses by stimulated emission. (ii) The second objective exceeds the ansatz of compensating losses and will reach out for lasing action. Individual metallic nanostructures such as pairs of nanoparticles will form novel and unusual nanometre sized resonators for laser action. State of the art microresonators still have a volume of at least half of the wavelength cubed. Noble metal nanoparticle resonators scale down this volume by a factor of thousand allowing for truly nanoscale coherent light sources. (iii) A third objective concerns a substantial improvement of nonlinear effects. This will be accomplished by drastically sharpened resonances of nanoplasmonic devices surrounded by active gain materials. An interdisciplinary team of PhD students and a PostDoc will be assembled, each scientist being uniquely qualified to cover one of the expertise fields: Design, spectroscopy, and simulation. The project s outcome is twofold: A substantial expansion of fundamental understanding of nanophotonics and practical devices such as nanoscopic lasers and low loss metamaterials.

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**NBR: 257159** **ACRONYM: MACALO** **EC FUND: 3174116**

**DG:** CNECT **Call: FP7-ICT-2009-5** **Thema:** ICT-2009.3.1

**Title:** Magneto Caloritronics

**Abstract:** MACALO has two main deliverables, one in software and one in hardware which form the core business of the two European high-tech companies in the consortium. The MACALO consortium consists of pioneers of MAgnetoCALOritronics who cover the complete chain from SME start-up company innovation in hardware and software, device simulation and fabrication, benchmark measurements, computational materials science, and basic science, who are committed to employ their expertise to realize the main objectives. The primary goals of MACALO are 1) to produce a working prototype of a computer simulation tool to help optimise integrated magnetoelectronic device design

parameters at the nanoscale and 2) design and prototype nano-scale magnetoelectronic RF oscillators with different combinations of desirable properties, optimisable subsequently (through further company research) for specific applications in wireless communication devices. Achieving these goals assists replacing the current systems of YIG oscillators, MRAM, and transistors with next generation magnetoelectronic Spin Torque Oscillators, ST-RAM, and transistors by finding material combinations, currently based on suboptimal experimental trial and error systems, using a set of theories, principles, tools and methods that accelerate the development of new devices with improved/optimised properties. Managing the increased heat and noise in the next generation of electronics is a great challenge. MAgneto CALOitronics (MACALO) addresses the modelling and control of the generation and flow of heat in beyond-CMOS magnetoelectronics circuits and devices. The results are relevant for thermal management of conventional CMOS and novel architectures beyond-CMOS such as low power, low-noise devices, thermally assisted memory devices, and interconnects.

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**NBR: 257182** **ACRONYM: CNTBBB** **EC FUND: 1229998**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE5

**Title:** Targeting potential of carbon nanotubes at the blood brain barrier

**Abstract:** Targeted drug delivery across the blood brain barrier (BBB) to the central nervous system is a large challenge for the treatment of neurological disorders. This 4 year ERC program is aimed towards the evaluating the BBB penetration capacity and toxicological potential of novel carbon nanotube (CNT) carriers using an integrated multidisciplinary approach. State-of-art characterisation techniques developed by the PI will be applied and further developed to detect the interaction of carbon nanotubes with in vitro BBB model and neuronal cells. Specific aims: 1. Identify the mechanisms of translocation of CNT across the endothelial cells which comprise the BBB, as well as uptake by neuronal cells in vitro. 2. To investigate the effect of length, diameter and surface charge of CNTs on the BBB and neuronal cells penetration capacity in vitro. 3. To investigate the toxicological profile of CNT on the BBB and the various neuronal cell types (immortalised and primary neuronal cultures). 4. Develop protocols to assess whether the CNTs degrade inside the cell. The ERC Grant will consolidate the new Research Group in nanomaterials-cell interfaces, and allow them to perform stimulating investigator-initiated frontier research in nanotoxicology and nanomedicine. To this end, a multi-disciplinary laboratory will be realized within the framework of this 4-year the ERC Programme. This will permit the group around the PI, to expand activities, push limits, create new boundaries, and develop new protocols for studying nanoparticle-cell interactions in close collaboration with ICL s Department of medicine and chemistry. Within the proposed program there is an underlying ambition both to gain a fundamental understanding for which parameters of CNTs determine their penetration

capacity through the BBB and also to assess their toxicological potential at the BBB two highlighted themes by the ERC.

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**NBR: 257241** **ACRONYM: MESOQMC** **EC FUND: 1222176**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE3

**Title:** Quantum Monte-Carlo in mesoscopic devices

**Abstract:** Understanding electronic correlations remains one of the biggest challenges of theoretical condensed matter physics. Mesoscopic systems, where electronic confinement can be externally controlled, are natural test beds for understanding the effects of correlations, and the lack of proper techniques to take them into account is acute. This project aims at developing new tools for simulating correlated quantum mesoscopic devices. We will combine standard approaches for transport in mesoscopic quantum systems with new quantum Monte-Carlo algorithms designed to capture correlations in those devices. We will use modern programming paradigms to develop a versatile numerical platform designed to be easily used by other research groups. These numerical tools will be closely related to existing analytical approaches so that we shall be able to make contact with standard many-body theory while go beyond the limitations of the analytical approaches. We will apply this new set of techniques to several problems that have been puzzling the community for some time including quantum transport in low-density two-dimensional gases for both bulk disordered systems (“Two dimensional metal-insulator transition”) and quantum point contacts (“0.7 anomaly”). We will also apply our techniques to several new problems of increasing importance: at finite-frequency, electron-electron interactions play a central role and must be taken into account properly. We will discuss high frequency measurements such as quantum capacitances, ac conductance or photo-assisted transport in a variety of materials (twodimensional gases of electrons or holes, graphene, semi-conductor nanowires…) and leverage on our new numerical tools to go beyond the standard mean field description.

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**NBR: 257244** **ACRONYM: NANOBITS** **EC FUND: 2499998**

**DG:** CNECT **Call: FP7-ICT-2009-5** **Thema:** ICT-2009.3.9

**Title:** Exchangeable and Customizable Scanning Probe Tips

**Abstract:** The atomic force microscope (AFM) has become a standard and wide spread instrument for characterizing nanoscale devices and can be found in most of today's research and development areas. The NanoBits project provides exchangeable and customizable

scanning probe tips that can be attached to standard AFM cantilevers offering an unprecedented freedom in adapting the shape and size of the tips to the surface topology of the specific application. NanoBits themselves are 2-4 µm long and 120-150 nm thin flakes of heterogeneous materials fabricated in different approaches. These novel tips will allow for characterizing three dimensional high-aspect ratio and sidewall structures of critical dimensions such as nanooptical photonic components and semiconductor architectures which is a bottle-neck in reaching more efficient manufacturing techniques. It is thus an enabling approach for almost all future nanoscale applications. A miniaturized robotic microsystem combining innovative nanosensors and actuators will be used to explore new strategies of micro-nano-integration in order to realize a quick exchange of NanoBits. For the fabrication of the NanoBits, two different techniques are proposed. On the one hand, a standard silicon processing technique enables batch fabrication of various NanoBits designs defined by electron beam lithography. On the other hand, focused ion beam milling can be used to structure a blank of heterogeneous materials, the socalled nembranes. Novel scanning modes in atomic force microscopy will be developed to take full advantage of the different NanoBits geometries and to realize AFM imaging of critical dimension structures. The innovative nanoimaging capabilities will be applied to characterize and develop novel nanooptical photonic structures in the wavelength or even sub-wavelength range and TERS applications in the nanomaterial and biomedical sector. Especially the involved SMEs will exploit and disseminate the results to potential users to realize a more efficient micro-and nanomanufacturing.

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**NBR: 257267** **ACRONYM: STEEPER** **EC FUND: 4099999**

**DG:** CNECT **Call: FP7-ICT-2009-5** **Thema:** ICT-2009.3.1

**Title:** Steep subthreshold slope switches for energy efficient electronics"

**Abstract:** STEEPER addresses the development of Beyond CMOS energy-efficient steep subthreshold slope transistors based on quantum mechanical band-to-band tunnelling (tunnel FETs), with the aim of reducing the operation voltage of nanoelectronic circuits to sub-0.5V, and their power consumption by one order of magnitude. STEEPER focuses on two technology tracks, united by same device principle, shared performance boosters, and compatibility with silicon CMOS. These are (i) Ultra-Thin-Body Silicon-On-Insulator technology for planar, tri-gate and nanowire tunnel FETs featuring ultra-low standby power and smartly exploiting additive boosters: high-k dielectrics, SiGe source, strain, and improved electrostatic design, and (ii) a III-V nanowire platform on silicon, as unique material to control staggered or broken bandgap boosters and devise a high performance (high-Ion, steep slope) implementation of tunnel FETs. Platform (i) will enable a hybrid platform combining high performance (HP) CMOS and low standby power (LSTP), low voltage tunnel FETs, supporting energy efficient hybrid CMOS/Tunnel-FET digital and analog/RF circuit design. In line with ITRS, STEEPER will evaluate in

platform (ii) the physical and practical limits of boosting the performance of tunnel FETs with III-V nanowires on silicon, and resulting advantages for HP digital circuits. The development of the two technology platforms are interactive and collaborative in terms of performance boosters, and will benefit from simulation and modelling support by the academic partners, and from investigation of the potentially critical variability and sensitivity of tunnel FETs. Industrial benchmarking is proposed at device and circuit levels by the key involved industries, and the figures of merit of hybrid CMOS/tunnel FET digital and analog circuit design will be investigated. The project targets energy efficient nanoelectronic technology for high volume markets covering digital, analog/RF and mixed mode applications.

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**NBR: 257280** **ACRONYM: FEMTOMAGNETISM** **EC FUND: 1500000**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE3

**Title:** Femtosecond Laser Control of Spins in Magnetic Materials: from fundamentals to nanoscale dynamics

**Abstract:** The aim of the project is to develop femtosecond optical control of magnetism: a new area at the junction of coherent nonlinear optics, near-field optics and magnetism. In particular, I am aiming to investigate nonthermal effects of light on magnetic order and to apply this knowledge for highly efficient ultrafast (10-12 seconds and faster) optical control of magnetism at the nanoscale. The ever increasing demand for faster information processing has triggered an intense search for ways to manipulate magnetically stored bits at the ultimately short time-scale. Although efficient, ultrafast and nonthermal laser control of magnetism may open new prospect of magnetic data storage and manipulation, many fundamental questions concerning the mechanisms that are responsible for the nonthermal effect of photons on spins and ultrafast laser induced changes of magnetic order are poorly understood. This is mainly because an ultrashort laser pulse brings a medium into a strongly non-equilibrium state where conventional description of magnetic phenomena in terms of thermodynamics is no longer valid. In this proposal I am planning to address these fundamental questions using novel experimental approaches for both the excitation and observation of magnetism on an ultrafast timescale. In particular, the proposal involves: a) development of polarization pulse shaping, where specially shaped laser pulses yield control over coherent optical excitations in a medium; b) exploring the ultrafast response of magnetic order with advanced optical and X-ray techniques. The ultimate goal is to combine the fundamental knowledge of femtosecond opto-magnetism obtained in this project with the methods of near-field optics to achieve ultrafast control of spins in magnetic nanostructures.

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**NBR: 257305** **ACRONYM: SUPRAFUNCTION** **EC FUND: 1500000**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-ID1

**Title:** Supramolecular materials for organic electronics: unravelling the architecture vs. function relationship

**Abstract:** SUPRAFUNCTION aims at mastering principles of supramolecular chemistry, in combination with top-down nanofabrication, to achieve a full control over the architecture vs. function relation in macromolecular materials for organic electronics, by analyzing and optimizing fundamental properties through which new capacities can emerge. Highly ordered supramolecularly engineered nanostructured materials (SENMs) will be self-assembled from conjugated 1D/2D molecules, and ultra-stiff multichromophoric arrays based on poly(isocyanides). Their interfaces with chemically functionalized top-down/bottom-up nanofabricated electrodes and with dielectrics will be tailored to reach SENM energy barriers with height

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**NBR: 257360** **ACRONYM: MOCAPAF** **EC FUND: 1476418**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-ID1

**Title:** Role of Molecular Clusters in Atmospheric Particle Formation

**Abstract:** Climate change is currently one of the central scientific issues in the world, and the ability to reliably forecast climate is crucial for making political decisions that affect the lives of billions of people. Aerosols remain the dominant uncertainty in predicting radiative forcing and future climate change, and also have adverse effects on human health and visibility. One of the least-well understood aerosol-related processes is nucleation: the formation of new particles from condensable vapours. While nucleation is related primarily to neutral clusters, state-of-the-art experimental methods measure only charged clusters. The main scientific objectives of this project are 1) to understand the chemical composition of charged and especially neutral atmospheric clusters from molecular to multi-nanometre scale, and explain the mechanism by which they nucleate, and 2) to direct current intense instrument development and provide theoretical tools to maximize the information on neutral clusters that can be obtained from experimental results on charged clusters. Our scientific plan consists of a multilevel computational effort to provide formation rates and properties of atmospheric clusters and particles to aerosol dynamic and climate modellers. To capture the properties of the smallest clusters, we need to perform quantum chemical calculations, combined with simulations on cluster formation kinetics. Unfortunately, these methods are computationally far too demanding to describe the entire nucleation process. Thus, we will feed quantum

chemical results to classical thermodynamic models, the results of which in turn must be parameterized for efficient use in larger-scale models.

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**NBR: 257372** **ACRONYM: SIMS** **EC FUND: 2949525**

**DG:** CNECT **Call: FP7-ICT-2009-5** **Thema:** ICT-2009.3.9

**Title:** Development of a Smart Integrated Miniaturised Sensor System for analytical challenges in diagnostics, industry and the environment

**Abstract:** The widespread availability of smart miniaturised systems is limited by the inability to integrate a sufficient number of functionalities into a single device at low cost and high volume using traditional production technologies. Organic, flexible and printed electronics (OFPE) offers this possibility. However, it too must overcome some significant challenges relating to device interfacing and fabrication. Key among these is the availability of subsystems (sensors, displays, power and circuitry) suitable for integration through OFPE, as well as the ability to combine these components through compatible processes. SIMS will develop a smart, miniaturised sensing system through the integration of a nanosensor, printed low cost display, mobile phone interface and printed battery with organic circuitry. Integration will take place on a single substrate employing photolithography, screen and ink jet printing and lamination. SIMS will be a platform technology. Its broad potential, including industrial and environmental monitoring, will be illustrated through the sensitive detection of hydrogen peroxide. However, due to the scale of the diagnostics market and its relevance to the partners, SIMS will focus on the quantitative measurement of cholesterol. SIMS will be low cost, disposable, and free from instrument calibration and maintenance. It will vastly expand the opportunities for distributed testing, creating new markets through innovative retailing opportunities. Increased testing will result in benefits to the health and the environment of people in Europe and beyond. The SIMS consortium includes three leading academic groups covering device physics, electroanalytical chemistry, materials science, electronic and production engineering, as well as two innovative SMEs in the full value chain from speciality materials suppliers, through mass producers, and to a global company in diagnostics with worldwide distribution networks.

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**NBR: 257375** **ACRONYM: NANOFUNCTION** **EC FUND: 2800000**

**DG:** CNECT **Call: FP7-ICT-2009-5** **Thema:** ICT-2009.3.1

**Title:** Beyond CMOS Nanodevices for Adding Functionalities to CMOS"

**Abstract:** The NANOFUNCTION Network of Excellence aims to integrate at the European level the excellent European research laboratories in order to strengthen scientific and technological excellence in the field of novel nanoelectronic materials, devices and circuits for developing new integrated functions and disseminate the results in a wide scientific and industrial community. This proposal will focus on the convergence of Advanced More than Moore devices (Analog-RF-sensors-actuators-biochips-energy harvesters, etc.) for adding functionalities to ICs and Beyond-CMOS nanostructures (nanowires, nanostructured materials, etc.) which could be integrated on CMOS platforms. In particular, the interest of these nanodevices for the development of innovative applications with increased performance in the field of nanosensing, energy harvesting, nanocooling and RF will be thoroughly investigated. This work will be carried out through a network of joint processing, characterisation and modelling platforms. The consortium will work closely with European industry and will feed back data and know-how on devices that deliver the required performance. This interaction will strengthen European integration in nanoelectronics, help in decision-making and ensure that Europe remains at the forefront of nanoelectronics for the next decades. Free keywords: -Beyond CMOS nanodevices -Advanced More than Moore technologies and applications -Innovative functionalities -Nanosensors -Energy harvesting -Nanocooling -Advanced RF materials and devices

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**NBR: 257488** **ACRONYM: E-BRAINS** **EC FUND: 10000000**

**DG:** CNECT **Call: FP7-ICT-2009-5** **Thema:** ICT-2009.3.9

**Title:** Best-Reliable Ambient Intelligent Nano Sensor Systems

**Abstract:** Best-Reliable Ambient Intelligent Nanosensor Systems – e-BRAINS – represent a giant leap for outstanding future applications in the area of ambient living with the ultimate need for integration of heterogeneous technologies, high-performance nanosensor devices, miniaturization, smart wireless communication and best-reliability. e-BRAINS with minimum volume and weight as well as reduced power consumption can be utilized in ambient living systems. Successful market entry of such innovative ambient intelligence products will be determined by the performance improvement achieved and the cost advantage in relation to the total system cost. The basic requirement for robustness and reliability of the heterogeneous integration technologies and the nanosensor layers is in the focus of all e-BRAINS developments. The designated nanosensor systems represent a very promising innovative approach with the potential to enable high-performance and precise functions in new products. The application of nanotechnology will allow large improvements in functionality and will open a wide range of applications for European companies. Future e-BRAINS applications require significantly higher integration densities. Performance, multi-functionality and reliability of such complex heterogeneous systems will be limited mainly by the wiring between the subsystems. Suitable 3D integration technologies create a basis to overcome these

drawbacks with the benefit of enabling minimal interconnection lengths. In addition to enabling high integration densities, 3D integration is a very promising cost-effective approach for the realization of heterogeneous systems. Besides the heterogeneous system integration the main criteria of e-BRAINS is the need for miniaturized energy storage/delivery systems, low power consumption, smart communication and methodology for reliability and robustness. e-BRAINS benefits from the established European 3D technology platform as major result of the IP e-CUBES.

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**NBR: 257511** **ACRONYM: EU-RU.NET** **EC FUND: 639432**

**DG:** CNECT **Call: FP7-ICT-2009-5** **Thema:** ICT-2009.3.1

**Title:** Linking R&D Strategies, Foresight and Stimulation of EU-Russia Cooperation in Nanoelectronics Technology

**Abstract:** A large number of leading European and Russian scientists led by the Vice-President of the Russian Academy of Sciences Nobel Laureate Professor Zhores Alferov, credited "for basic work on information and communication technology" – the invention of heterotransistor and the first double heterostructure laser diode to achieve continuous wave operation, have come together in this project with the sole purpose of strengthening the EU-Russia cooperation in Nanoelectronics Technology. This is in line with the EU strategy of deepening and broadening the international aspect of its science and technology policy. Cooperation with Russia is an important part of it, and today a great leap forward has taken place by proposing a linkage between EU and Russian strategies for the development of Nanoelectronics Technology – an essential element for keeping European industry competitive at global level. To reach the objective of the EU-RU.NET Project, the consortium of five EU and five Russian organisations will identify the most urgent and promising fields for cooperation, will set up several working groups of experts, and will support participation of EU and Russia scientists at different events with presentations and organisation of round tables and brokerage events that will bring scientists together to allow discussions and setting of new collaborations. Over ten Pilot Trial Projects carried out in the frame of EU-RU.NET Project will help Participants identify the bottlenecks of cooperation and propose improvements. A Foresight study for the future of EU-Russia cooperation in Nanoelectronics Technology will be carried out. The Strategy Experts Group will analyse the results and achievements of the Project and will develop roadmaps and propose new actions. Recommendations on linking strategies and strengthening cooperation will be prepared for the EU and Russian officials responsible for the development of Nanoelectronics Technology. Project deliverables will demonstrate to the public the advantages of cooperation between EU and Russia.

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**NBR: 257531** **ACRONYM: ENSENA** **EC FUND: 1259725**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE2

**Title:** Entanglement from Semiconductor Nanostructures

**Abstract:** At the interface between quantum optics and semiconductors we find a rich field of investigation with huge potential for quantum information processing communication technologies. Entanglement is one of the most fascinating concepts in quantum physics research as well as an important resource for quantum information processing. This project will develop novel sources of entangled photon pairs with semiconductor nanostructures. In particular, we will use the scattering of microcavity exciton-polaritons as an extremely strong optical nonlinearity for the generation of entanglement with properties that are difficult to achieve with the traditional methods. Further we will work with individual semiconductor quantum dots to create controlled single entangled pairs and explore the interfacing of quantum dots to flying qubits. The long term vision of this research is to create integrated sources of entanglement that can be combined with laser sources, passive optical elements, and even detectors in order to realize the quantum optics lab on a chip.

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**NBR: 257654** **ACRONYM: SPINTROS** **EC FUND: 1283400**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE5

**Title:** Spin Transport in Organic Semiconductors

**Abstract:** Spintronics is an area of electronics that aims to exploit the spin of the electron. Although it is one of the areas selected to play a role in the post-CMOS electronics, spintronics still has to prove its full potential in many fields. A particularly important is the long distance spin transport and manipulation. Organic semiconductors (OSC) can play an important role in the development of spintronics as they have very small spin-orbit and hyperfine interactions, which lead to very long spin coherence times and make them ideal for spin transport. However, the basic mechanisms of spin injection, transport and manipulation in OSC are still obscure, thus impeding further advances in the field. The objective of this project is to understand and control spin transport in organic semiconductors. To achieve this ambitious objective we will employ a multidisciplinary approach, merging materials science, electronics and physics. In the two initial workpackages, we will study the unique combination of ferromagnetic spin-polarized injectors and OSC spin transporters, especially their energetic and magnetic interactions at the interface. We will also create optimized organic field-effect transistors (OFET) with nanometre channel lengths, the only device that would allow us to understand spin transport in a controllable fashion. In the third workpackage we will

create and investigate the Spin OFET. Thanks to this device we will quantify the spin coherence length of OSC and we shall be able to control spin transport either by external (magnetic or electric field) or internal (crystallographic) effects. Finally, we will produce and characterize spin single molecular FETs. With this radical downscaling we will explore effects inaccessible in other transport regimes. For example, we will look at the direct coupling between the spin and molecular vibrational modes, or to the effect of the spin on the Kondo effect.

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**NBR: 257733** **ACRONYM: SMARTFIBER** **EC FUND: 3050000**

**DG:** CNECT **Call: FP7-ICT-2009-5** **Thema:** ICT-2009.3.9

**Title:** Miniaturised Structural Monitoring System with Autonomous Readout Micro-Technology and Fiber sensor network

**Abstract:** In this project, we will develop a smart miniaturized system which integrates optical fiber sensor technology, nano-photonic chip technology and low power wireless technology. The smart system will enable for the first time fully embedded structural health monitoring of composites used as structural parts in e.g. wind turbine blades, satellites, airplanes, civil constructions, oil and gas wells, boat hulls. Due to the innovative approach of integrating micro-technologies, SMARTFIBER will demonstrate a smart system so small (order mm's) that it can be embedded as a whole in the fiber reinforced polymer. As such, the system takes away the main technical roadblock for the industrial uptake of optical fiber sensors as structural health monitoring technology in composite structures: embedding of both fiber sensor and fiber interrogator omits the fragile external fiber coupling to an external interrogator. SMARTFIBER will drive ICT to make truly intelligent composites. The technologies to be integrated –optical fiber Bragg grating sensors, nano-photonic chip technology and low power wireless technology- have all proven practicability. SMARTFIBER envisages the high risk of integrating the technologies to a system that both complies with the composite manufacturing process and performs well when embedded in a fiber reinforced polymer. The technology will be integrated and demonstrated in a real production environment. The large industrial involvement in SMARTFIBER is significant. The value chain of the microsystem is fully covered by the partners' activities. This strategy gives industrial take-up and commercial development of the technology a huge chance. The smart miniaturized systems will provide the user a continuous record of structural data which will inform decisions on maintenance, thereby obviating the need for expensive, periodic maintenance, as well as warning of potentially catastrophic mechanical failures, increasing safety remarkably.

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**NBR: 257750** **ACRONYM: GREEN SILICON** **EC FUND: 1660000**

**DG:** CNECT **Call: FP7-ICT-2009-5** **Thema:** ICT-2009.8.6

**Title:** Generate Renewable Energy Efficiently using Nanofabricated Silicon

**Abstract:** The primary objective of this project is to demonstrate integrated on-chip thermoelectric energy harvesting using micro-/nano-fabricated Si/SiGe nanostructures with improved efficiencies through the use of band-structure and phonon engineering. High performance thermoelectric materials require high electrical conductivity and low thermal conductivity. Our approach is to engineer thermoelectric materials which enhance the electrical conductivity while simultaneously blocking the tranport of thermal energy through the devices. Bulk 2D Si/SiGe superlattices, laterally patterned 1D nanowires and 0D quantum dots made from Si/SiGe heterostructure technology will be investigated for high performance thermoelectrics in microsystems and other applications. We propose to combine the optimum 2D superlattice or 0D quantum dot material with 1D nanowire patterning to further improve the thermoelectric performance of microgenerators. The final optimised thermoelectric generator will be integrated with a capacitor energy store on a mm-sized single silicon chip to demonstrate a power source for an autonomous system. This will be used to power a micropower CMOS sensor to demonstrate its use as an energy harvesting system. The developed technology will be compatible with the power supply requirements for wireless autonomous systems such as those defined in the IEEE 802.15.4 standard. While the project is aimed at on-chip sustainable energy generation, the techniques, technology and IP being developed will also be able to be deployed into high efficiency (>20%) thermoelectric generators and Peltier coolers for domestic and industrial applications.

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**NBR: 257829** **ACRONYM: CONCEPTGRAPHENE** **EC FUND: 3229780**

**DG:** CNECT **Call: FP7-ICT-2009-5** **Thema:** ICT-2009.3.1

**Title:** New Electronics Concept: Wafer-Scale Epitaxial Graphene

**Abstract:** The concept of this project is to unlock the potential of epitaxial graphene on silicon carbide (SiC) for development of scalable electronics with the view to develop graphene-based devices & circuits with a non-conventional functionality. Our strategy is to explore two promising directions of graphene-based technology: (i) the development of large-scale graphene wafers for manufacturing high-density of devices on a single SiC wafer, and (ii) the development of hybrid circuits for applications of graphene in spintronics and metrology by exploiting the flexibility for design offered by the large area of graphene on SiC. The consortium of bidders brings together groups with complementary expertise and substantial achievements in the relevant area of graphene research and nanotechnology in general. The objectives are to (1) reliably produce large-area

graphene with a controlled carrier density and improved transport characteristics; (2) pattern graphene for applications using industrial nanostructuring and nanofabrication methods, aiming at high integration densities with a good yield of working devices; (3) produce a prototype for a graphene-based Quantum Hall Resistance standard with characteristics surpassing existing silicon- and GaAs-based devices; (4) develop a pilot version of spintronic devices of epitaxial graphene; (5) start exploiting the commercial potential of graphene by establishing a start-up company that will produce graphene wafers for users outside this consortium. These objectives relate directly to major parts of the call, namely, the need for new circuit architechtures, metrology and characterization techniques; new device structures for non-Si and Si based advanced integrated components to add functionality to circuits and (sub)systems; and new technologies and functional devices beyond CMOS.

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**NBR: 257856** **ACRONYM: SINAPS** **EC FUND: 2369999**

**DG:** CNECT **Call: FP7-ICT-2009-5** **Thema:** ICT-2009.8.6

**Title:** Semiconducting Nanowire Platform for Autonomous Sensors

**Abstract:** The aim of the SiNAPS project is to develop standalone “dust”-sized chemical sensing platforms that harvest energy from ambient electromagnetic radiation (light) and will enable miniaturisation below the current mm^3 barrier. Current solutions in nanoelectronics are enabled by new materials at the nanoscale. It is proposed to use high-density semiconductor nanowire arrays, such as Si and Ge, as efficient photovoltaic units and low-power chemical sensing elements on small volume modules to be integrated, via 3D system in a chip, in a miniaturised platform that transmits the acquired information wirelessly for further processing. To demonstrate the proof-of-concept without committing huge resources in optimization the SiNAPS project has set a pragmatic but ambitious, miniaturisation target ~10^8 µm^3, beyond the state-of-the-art. With further development of the energy harvesting and sensing technology, 10^6 µm^3 and below can be possible. SiNAPS brings together a consortium to address the two topics of the ICT-Proactive call, namely: (a) fundamentals of ambient energy harvesting at the nanoscale and (b) development of self powered autonomous sensor devices, with target dimensions of 1 mm^3. These topics are of great interest in the areas of energy supply, energy use in ICT, smart(er) buildings, medical diagnostics, e-health and integrated smart systems. SiNAPS involves the development of the capacity of nanowires for use as a nanoscale energy harvester and a (bio-)chemical sensor for the prototype biotin-streptavidin system via fundamental studies. Miniaturised CMOS electronics will be developed for efficient power management and sensor interface. Existing IP for wireless communication will be used to avoid costly development. The integrated modules will be used to demonstrate the SiNAPS mote concept. Concluding SiNAPS, a set of new technologies for self powered autonomous devices and beyond will be available for further development towards commercialisation.

**NBR: 257964** **ACRONYM: NANO-TEC** **EC FUND: 720000**

**DG:** CNECT **Call: FP7-ICT-2009-5** **Thema:** ICT-2009.3.1

**Title:** ECOSYSTEMS TECHNOLOGY and DESIGN for NANOELECTRONICS

**Abstract:** NANO-TEC seeks to build a community of academic researchers in nanoelectronics, addressing specifically research in Beyond CMOS from the combined technology and design perspectives. A methodology for continued consultation and analysis of research needs and trends will be developed. The main activity will be a workshop series with invited experts, preceded by a methodology-contents preparation phase and subsequent analysis and documentation, both by the consortium. Apart of determining what is relevant for Beyond CMOS devices and design, benchmarking and a SWT analysis will be performed. An end-of-the-project public dissemination event will present the results of the work of NANO-TEC to stake-holders, including the EC and relevant ETPs. Two elements are crucial here. One is the access to the huge expertise in Europe, albeit fragmented, in the area of Beyond CMOS both in technology and in design. The other is a platform to carry out the work and document it. The former is inherent to the consortium, although non-exclusive, as partners come mainly from institutions which have a tradition of nanofabrication for nanoelectronics research and or are members of national consortia and as such have contacts to leading researcher in Beyond CMOS Nanoelectronics. The latter is part of the long-term community-building aim and is a web-platform that will enable documents and exchanges to take place, as well a be the place where the working groups can evolve into a Specialist Interest Group on the combined ecosystems of technology and design.

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**NBR: 258023** **ACRONYM: MNIQS** **EC FUND: 905700**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE1

**Title:** Mathematics and Numerics of Infinite Quantum Systems

**Abstract:** The purpose of the project is to study linear and nonlinear models arising in quantum mechanics and which are used to describe matter at the microscopic and nanoscopic scales. The project focuses on physically-oriented questions (rigorous derivation of a given model from first principles), analytic problems (existence and properties of bound states, study of solutions to timedependent equations) and numerical issues (development of reliable algorithmic strategies). Most of the models are nonlinear and describe physical systems possessing an infinite number of quantum particles, leading to specific difficulties. The first part of the project is devoted to the study of relativistic

atoms and molecules, while taking into account quantum electrodynamics effects like the polarization of the vacuum. The models are all based on the Dirac operator. The second part is focused on the study of quantum crystals. The goal is to develop new strategies for describing their behavior in the presence of defects and local deformations. Both insulators, semiconductors and metals are considered (including graphene). In the third part, attractive systems are considered (like stars or a few nucleons interacting via strong forces in a nucleus). The project aims at rigorously understanding some of their specific properties, like Cooper pairing or the possible dynamical collapse of massive gravitational objects. Finally, the last part is devoted to general properties of infinite quantum systems, in particular the proof of the existence of the thermodynamic limit

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**NBR: 258060** **ACRONYM: FUNCMOLQIP** **EC FUND: 1500000**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE5

**Title:** Design and Preparation of Functional Molecules for Quantum Computing and Information Processing

**Abstract:** The future of Nanotechnology depends inevitably on the creation of molecular devices capable of performing crucial functions. We propose new strategies for the design and synthesis of molecular functional materials based on coordination chemistry, as well as the study of their physico-chemical properties in order to evaluate their relevance in the context of molecular spintronics and electronics. The main rationale underlying these strategies stems from the conviction that the unlimited potential of coordination compounds may be greatly exploited if the processes of self assembly leading to these systems are controlled and manipulated through the careful design of the ligands that will shape their structure and properties. We have designed the synthesis of new families of multinucleating ligands intended to form polynuclear coordination molecules with predetermined structures. Preliminary analysis of their performance has served to identify entries into novel categories of Single Molecule Magnets, SMMs, and Molecular Cluster Pairs, MCPs. The latter are stable molecules that exhibit two quasi independent metallic clusters, which fulfil many of the requirements necessary to act as 2qbit quantum gates for processors in quantum computing. We propose a full synthetic programme aimed at exploiting and expanding this promising avenue toward the fabrication of molecular systems that will be exploited in the context of Quantum Information Processing, QIP. In particular, we have identified from our previous work three classes of MCPs with promising features towards that end. We aim at exploiting the tools that we have created and develop new synthetic resources for the synthesis of robust molecules with the ability to act as 2qbits in QIP based on magnetic nanoclusters.

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**NBR: 258203** **ACRONYM: SMART-EC** **EC FUND: 5100000**

**DG:** CNECT **Call: FP7-ICT-2009-5** **Thema:** ICT-2009.3.9

**Title:** Heterogeneous integration of autonomous smart films based on electrochromic transistors

**Abstract:** SMART-EC aims at the development of self powered (energy harvesting and storage) EC device integrating EC thin film transistor component on a flexible substrate for energy saving, comfort and security in automotive, e-cards and smart packaging sectors. The objective is to overcome the current limitations related to low switching time and manufacturing costs; the switching time can be reduced (<1s) by introducing nanostructured EC materials, innovative EC transistors and high ionic conductive solid electrolytes. Radical innovative cheap manufacturing technologies on large area PVD, inkjet and roll-to-roll processes on low cost plastic will be developed. These processes are fully compatible with heterogeneous integration of several functions to produce a completely autonomous device (thin film battery, PV cell, sensors and communication) with great added value respect to traditional solutions. The optimization of co-integrated (separated building blocks laminated together) and convergence (using same materials for different building blocks) approaches will allow to fabricate a fully autonomous system. The first step will be the optimization of deposition and patterning technologies in terms of processes parameters and in-situ monitoring to allow the high control of film growth; the second step will be the heterogeneous integration of the different building blocks to produce the self-powered systems for the targeted applications. Four academic and research institutes guarantee a high level interdisciplinary research on solid-state physics, material chemistry and integration; this will assures the proper technology transfer to industrial partners at all product chain levels (materials, devices and end users) for a successful exploitation of results. SMART-EC materials and technologies are original and will pave the way for future generation smart surfaces with great potential impact at medium and long term (flexible and transparent electronics) applications.

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**NBR: 258221** **ACRONYM: SINSLIM** **EC FUND: 1496600**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE4

**Title:** Smart Inorganic Nanocrystals for Sub-diffraction Limited IMaging

**Abstract:** The goal of this proposal is to design and fabricate "smart" inorganic fluorophores, which could replace to replace currently used organic dyes for far-field sub-diffraction limited microscopy applications. Delicate band-gap engineering of the structure and composition of colloidal semiconductor nanocrystals is suggested as a path to achieving

the required nonlinear all-optical control over their luminescent properties. In conjunction with the inherent photostability, tunability and ease of excitation of these nanocrystals, this can pave the way towards greatly simplified instrumentation and techniques, implying dramatically reduced costs and significantly broader accessibility to sub-diffraction limited imaging. The proposed research is a concerted effort both on colloidal synthesis of complex multicomponent semiconductor nanocrystals and on time and frequency resolved photophysical studies down to the single nanocrystal level. Several schemes for photoactivation and reversible photobleaching of designed nanocrystals, where the localization regime of excited carriers differs between the electrons and the holes, will be explored. These include effective ionization of the emitting nanocrystal core and optical pumping of two-color emitting QDs to a single emitting state. Fulfilling the optical and material requirements from this type of system, including photostability, control of intra-nanocrystal charge- and energy-transfer processes, and a large quantum yield, will inevitably reveal some of the fundamental properties of the unique system of strongly coupled quantum dots in a single nanocrystal.

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**NBR: 258238** **ACRONYM: PHAST-ID** **EC FUND: 2680000**

**DG:** CNECT **Call: FP7-ICT-2009-5** **Thema:** ICT-2009.3.7

**Title:** Robust, affordable photonic crystal sensors for point-of-care disease diagnostics

**Abstract:** Point-of-care testing is essential to provide better patient care by aiding physicians in making informed decision during patient visits. This will enable the start of immediate treatment for many conditions and reduce the strain on resources in secondary care, resulting in reduced outpatient clinic time. A key challenge in the development of point-of-care diagnostic devices is the requirement for robust, rapid and simple assay formats with direct readout, coupled with small sensing areas (~10 x 10 µm) and low sample volumes (25 µl) that exhibit the same sensitivity as laboratory based tests. The RAPID project will address this challenge by developing an integrated multichannel 2D photonic crystal based disposable biosensor and bench top reader, for point-of-care disease diagnostic applications. The RAPID disposable sensor will demonstrate enhanced performance beyond the state of the art in key proteomic diagnostic systems by delivering direct robust label-free detection of four pancreatic cancer serum biomarkers at less than 100 fM (5 pg/ml) concentrations. Objective genetic algorithms will be developed for infometric and chemometric pattern recognition to allow unequivocal identification of protein cancer biomarkers following collection of the data from the sensor platform. In this manner, the project will support the development of future device innovation in proteomics and disease diagnostics that could yield revolutionary advances in healthcare and nanomedicine. A successful RAPID project will provide a number of clear benefits over the current label-free commercial offerings: speed, cost

and ease of use and make the outputs of the RAPID project very attractive commercially in the PoC diagnostic markets.

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**NBR: 258292** **ACRONYM: ALLQUANTUM** **EC FUND: 1199648**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE2

**Title:** All-solid-state quantum electrodynamics in photonic crystals

**Abstract:** In quantum electrodynamics a range of fundamental processes are driven by omnipresent vacuum fluctuations. Photonic crystals can control vacuum fluctuations and thereby the fundamental interaction between light and matter. We will conduct experiments on quantum dots in photonic crystals and observe novel quantum electrodynamics effects including fractional decay and the modified Lamb shift. Furthermore, photonic crystals will be explored for shielding sensitive quantum-superposition states against decoherence. Defects in photonic crystals allow novel functionalities enabling nanocavities and waveguides. We will use the tight confinement of light in a nanocavity to entangle a quantum dot and a photon, and explore the scalability. Controlled ways of generating scalable and robust quantum entanglement is the essential missing link limiting quantum communication and quantum computing. A single quantum dot coupled to a slowly propagating mode in a photonic crystal waveguide will be used to induce large nonlinearities at the few-photon level. Finally we will explore a novel route to enhanced light-matter interaction employing controlled disorder in photonic crystals. In disordered media multiple scattering of light takes place and can lead to the formation of Anderson-localized modes. We will explore cavity quantum electrodynamics in Anderson-localized random cavities considering disorder a resource and not a nuisance, which is the traditional view. The main focus of the project will be on optical experiments, but fabrication of photonic crystals and detailed theory will be carried out as well. Several of the proposed experiments will constitute milestones in quantum optics and may pave the way for all-solid-state quantum communication with quantum dots in photonic crystals.

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**NBR: 258461** **ACRONYM: TERATOMO** **EC FUND: 1455600**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE3

**Title:** Near-field Spectroscopic Nanotomography at Infrared and Terahertz Frequencies

**Abstract:** Fundamental understanding and engineering of composite materials, biological structures and building blocks for electrical and optical devices of nanoscale dimensions necessitate the availability of advanced microscopy tools for mapping their local

chemical, structural and free-carrier properties. But while optical spectroscopy, particularly in the infrared (IR) and terahertz (THz) frequency range, has tremendous merit in measuring such properties optically, the diffraction-limited spatial resolution has been preventing IR and THz microscopy applications for the longest time to be used in nanoscale materials and device analysis, bioimaging, industrial failure analysis and quality control. During the last years we pioneered the field of IR and THz near-field microscopy, which allows twodimensional (2D) spectroscopic IR and THz imaging of a sample surface with nanoscale spatial resolution, independent of the wavelength. Key achievements of our work are the nanoscale resolved near-field mapping of chemical compositions of polymer blends, mechanical strain fields in ceramics and free-carrier concentrations in doped semiconductor transistors. The core objective of this proposal is to develop a three-dimensional (3D) spectroscopic imaging method in a wide spectral range between infrared (IR) and terahertz (THz) frequencies with nanoscale spatial resolution, a method that does not and not even nearly exist today. Our approach will be based on scatteringtype scanning near-field optical microscopy (s-SNOM), even though s-SNOM is generally considered to be a surface mapping technique. Instead of scanning the surface, it is proposed to scan a volume above the sample surface. By using appropriate reconstruction methods, the three-dimensional structure of the sample volume below the sample surface could be obtained in principle. We recently conducted a theoretical study, which confirmed the fundamental feasibility of this novel approach that shall be experimentally realized within this proposal. The proposed method of IR and THz nanotomography could become a new paradigm in nanoscale optical imaging. Near-field nanotomography will have the potential to open new and even unexpected avenues for optical characterization throughout all nanosciences, such as non-invasive, chemical identification of single (biological) nanoparticles in complex 3D-nanostructures or the measurement of the local free-carrier concentration and mobility in semiconductor nanowires or devices with 3D-architecture.

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**NBR: 258509** **ACRONYM: MULTIMATE** **EC FUND: 1484700**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE8

**Title:** A Research Platform Addressing Outstanding Research Challenges for Nanoscale Design and Engineering of Multifunctional Material

**Abstract:** Nanoscale engineering is a fascinating research field spawning extraordinary materials which revolutionize microelectronics, medicine,energy production, etc. Still, there is a need for new materials and synthesis methods to offer unprecedented properties for use in future applications. In this research project, I will conduct fundamental science investigations focused towards the development of novel materials with tailor-made properties, achieved by precise control of the materials structure and compostition. The objectives are to: 1) Perform novel synthesis of graphene. 2) Explore nanoscale engineering of "graphene-based" materials, based on more than one atomic element. 3)

Tailor uniquely combined metallic/ceramic/magnetic materials properties in so called MAX phases. 4) Provide proof of concept for thin film architectures in advanced applications that require specific mechanical, tribological, electronic, and magnetic properties. This initative involves advanced materials design by a new and unique synthesis method based on cathodic arc. Research breakthroughs are envisioned: Functionalized graphene-based and fullerene-like compounds are expected to have a major impact on tribology and electronic applications. The MAX phases are expected to be a new candidate for applications within low friction contacts, electronics, as well as spintronics. In particular, single crystal devices are predicted through tuning of tunnel magnetoresistance (TMR) and anisotropic conductivity (from insulating to n-and p-type). I can lead this innovative and interdisciplinary project, with a unique background combining relevant research areas: arc process development, plasma processing, materials synthesis and engineering, characterization, along with theory and modelling.

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**NBR: 258593** **ACRONYM: SEQUENCES** **EC FUND: 1200000**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE5

**Title:** New Strategies for Controlling Polymer Sequences

**Abstract:** Sequence-controlled polymerizations play a key role in Nature. Although formed from a rather modest library of monomers, sequence-defined macromolecules such as proteins or nucleic acids are largely responsible for the complexity and diversity of the biological world. By analogy, one may predict that synthetic sequence-defined polymers could play an important role in modern applied materials science. Paradoxically, very little effort has been spent within the last decades for developing sequence-specific polymerization methods. In this scientific context, the target of the present proposal is to develop new approaches for controlling macromolecular sequences. In particular, new possibilities for controlling comonomer sequences in standard synthetic processes such as chain-growth polymerizations (e.g. controlled radical polymerization) and step-growth polymerizations will be investigated. The strategies for controlling sequences will be principally chemical (e.g. controlled monomer insertion, organocatalysis, sequential monomer additions) but physical (e.g. confinement, transient monomer complexation) and eventually biochemical (e.g. biocatalysis) routes will be also considered. The essence of this project is indeed highly fundamental. Indeed, the control over polymer sequences remains one of the last holy grails in polymer science. Nevertheless, on a longer term, this research may be also extremely relevant for applications. Indeed, sequence-controlled polymers are most likely the key towards new generations of functional sub-nanometric materials.

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**NBR: 258608** **ACRONYM: HANDY-Q** **EC FUND: 1488307**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE3

**Title:** Quantum Degeneracy at Hand

**Abstract:** Microcavity polaritons are half-light, half-matter composite bosons, which are formed in monolithic semiconductor microcavities of the proper design. Recently, Bose-Einstein condensation of polaritons has been reported, that constitutes a new class of quantum fluid out of equilibrium. Unlike cold atoms, superfluid Helium or superconductors, polaritons are in a driven-dissipative situation, and their mass amounts only to a negligible fraction of an electrons'. This unusual situation has already revealed very interesting phenomena. Moreover, every observables of the polariton fluid, including momentum, energy spectrum and coherence properties are directly accessed via optical spectroscopy experiments. In this project, we will fabricate and investigate new wide band-gap semiconductor nanostructures both capable of taking unprecedented control over the polariton environment, and capable of sustaining very hot and very dense quantum degenerate polariton fluids. Various confinement configurations - two, one and zero-dimensional -will be realized as well as advanced nanostructures based on traps and tunnel barriers. In these peculiar situations, the quantum degenerate polariton fluid will display a new and rich phenomenology. Hence, many premieres will be achieved like room temperature 1D quantum degeneracy, 1D quasi-condensate in solid-state systems, Josephson oscillations of polariton superfluids, and the fascinating Tonks-Girardeau state where strongly interacting bosons are expected to behave like fermions.

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**NBR: 258613** **ACRONYM: BIOMOF** **EC FUND: 1492970**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE5

**Title:** Biomineral-inspired growth and processing of metal-organic frameworks

**Abstract:** This ERC-StG proposal, BIOMOF, outlines a dual strategy for the growth and processing of porous metal-organic framework (MOF) materials, inspired by the interfacial interactions that characterise highly controlled biomineralisation processes. The aim is to prepare MOF (bio)-composite materials of hierarchical structure and multi-modal functionality to address key societal challenges in healthcare, catalysis and energy. In order for MOFs to reach their full potential, a transformative approach to their growth, and in particular their processability, is required since the insoluble macroscopic micron-sized crystals resulting from conventional syntheses are unsuitable for many applications. The BIOMOF project defines chemically flexible routes to MOFs under mild conditions, where the added value with respect to wide-ranging experimental procedures for the growth and processing of crystalline controllably nanoscale MOF materials with tunable structure and functionality that display significant porosity for

wide-ranging applications is extremely high. Theme 1 exploits protein vesicles and abundant biopolymer matrices for the confined growth of soluble nanoscale MOFs for high-end biomedical applications such as cell imaging and targeted drug delivery, whereas theme 2 focuses on the cost-effective preparation of hierarchically porous MOF composites over several length scales, of relevance to bulk industrial applications such as sustainable catalysis, separations and gas-storage. This diverse yet complementary range of applications arising simply from the way the MOF is processed, coupled with the versatile structural and physical properties of MOFs themselves indicates strongly that the BIOMOF concept is a powerful convergent new approach to applied materials chemistry.

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**NBR: 258616** **ACRONYM: SEMANTICS** **EC FUND: 1405632**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE4

**Title:** Semiconducting and Metallic nanosheets: Two dimensional electronic and mechanical materials

**Abstract:** We will develop simple, scalable methods to exfoliate layered compounds into monolayer nanosheets. These materials have exciting properties. Recently, graphene has taken the nanomaterials community by storm. However graphene is only one branch of a family of two dimensional layered compounds. Other examples include hexagonal BN, metal dichalcoginides such as MoS2 and metal oxides such as MnO2. We propose that all layered compounds can be exfoliated in certain solvents by the addition of ultrasonic energy. Such a method has not been demonstrated because the vast majority of solvents are unsuitable for this. We propose that suitable solvents can be identified by matching their surface energy to that of the nano crystal, rendering the exfoliation process energy neutral. This will open the gate to a wide range of nano-materials science and makes possible experiments that have been impossible using standard techniques. We will pick a set of layered compounds such as the semiconductors; hexagonal BN, MoS2 and TaO3 and the metals TaS2 and MnO2. We will learn to exfoliate these materials, studying the physics and chemistry of the solvent-nanosheet interaction. Once we can generate large volumes of highly exfoliated nanosheets at high concentration, we will study the physics of these materials. We will start at the macroscale, preparing free standing films of restacked sheets and polymer-sheet composites for mechanical applications. Thin films can also be studied as transparent conductors and capacitor dielectrics. Hybrid films can be used to study electroluminescence or photovoltaic action. At the nanoscale, single BN layers would make ideal gate dielectrics for monolayer MoS2 transistors. In addition overlapping layers of MoSe2 and MoTe2 could make atomic scale solar cells. Overlaying TaS2 and MnO2 sheets on either side could act as the electrodes. Thus these materials represent a nanoscale playground to study mechanics and electronics on scales from nano to macro.

**NBR: 258658** **ACRONYM: EARLY EARTH** **EC FUND: 1306742**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE10

**Title:** Early Earth Dynamics: Pt-Re-Os isotopic constraints on Hadean-Early Archean mantle evolution

**Abstract:** This project aims to directly constrain the melting history and composition of the mantle of the Earth for the first 750 Ma of its history. So far, our limited knowledge hinges on isolated detrital zircons from Archean crustal rocks. They indicate crustal extraction as early as 4.4 Ga with peaks at 4.0 and 4.3 Ga but reveal conflicting models for the composition of the Hadean mantle. Both the timing and extent of these early crust formation events and the composition of the Hadean mantle have crucial implications for our understanding of the Early Earth's chemical evolution and dynamics as well as crustal growth and thermal cooling models. Sulfides (BMS) and platinum group minerals (PGM) may hold the key to these fundamental issues, as they are robust time capsules able to preserve the melting record of their mantle source over several billion years. I propose to perform state-of-the-art in-situ Pt-Re-Os isotopic measurements on an extensive collection of micrometric BMS and PGM from Archean cratonic peridotites and chromite deposits, and paleoplacers in Archean sedimentary basins. For the first time,< 20 µm minerals will be investigated for Pt- Re-Os. The challenging but high-resolution micro-drilling technique will be developed for in-situ sampling of the PGM and BMS with subsequent high-precision 187Os-186Os isotopic measurements by NTIMS. This highly innovative project will be the first to constrain Hadean Earth history from the perspective of the Earth's mantle. By opening a new window towards high-precision geochemical exploration for micrometric minerals, this project will have long-term implications for the understanding of the micro to nano-scale heterogeneity of isotopic signatures in the Earth's mantle and in extra-terrestrial materials.

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**NBR: 258748** **ACRONYM: THERMOS** **EC FUND: 1224999**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE4

**Title:** The protein thermostability: same activity, different working temperature. A water problem? A rigidity/flexibility trade-off?

**Abstract:** The proteins from thermophilic organisms are the objects of the present study. Here it is specifically proposed a study on the microscopic origin of proteins thermostability using a multi-computational approach. The multi-methodological strategy is a powerful tool for exploring this issue since it allows an investigation at many different levels of

molecular details. Neutron Scattering experiments will complement the in silico investigation. The present study will tackle the issue of thermostability under a new light by explicitly focusing on the role of hydration water and by carefully selecting homologues proteins from mesophilic, thermophilic and hyperthermophilic organisms as cases of study. I will investigate how the chemical composition of a protein surface, the distribution of charged, polar and hydrophobic amino acids, could be tuned in order to increase/reduce thermal resistance of the hydration layer and of the protein matrix. I will examine whether thermostability correlates to the flexibility or the rigidity of the protein matrix and/or of its hydration skin. I will study in details how the catalytic activity of enzymes is affected by the dynamics of the protein at extreme temperatures. The theoretical study will be supported by Neutron Scattering experiments gaining key knowledge on the structure and dynamics of hydration water and on the dynamics of proteins in the nanosecond time scale. Nowadays the possibility to design functional thermostable proteins is strategic for expanding the use of enzymes in industrial processes and in biotechnology. The study of the coupling between hydration water and protein surface could pave the way for the computer-aided engineering of thermostable proteins.

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**NBR: 258753** **ACRONYM: QUANT-DES-CNT** **EC FUND: 1499940**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE3

**Title:** Quantum Design in Carbon Nanotubes

**Abstract:** Quantum design, the ability to control the microscopic properties of a quantum system, has proven to be an invaluable tool in experimental physics. Carbon nanotubes are an ideal system to implement quantum design in the solid-state; their strongly interacting electrons, unusual spin properties, and unique mechanical qualities make them an excellent platform for studying quantum phenomena in low dimensions. However, for many years this potential has been hindered by the dominance of strong electronic disorder in this system. Fortunately, a series of recent breakthroughs in making nanotubes free of disorder has dramatically changed this situation, opening up a wide range of opportunities for high-precision experiments in these systems. In this work I propose to develop a new technology that will enable quantum design experiments in carbon nanotubes. This technology, which builds on my recent development of ultra-clean electronic devices in nanotubes, will allow us to create nanotube device-architectures that go far beyond those currently available. Specifically, we will be able to control the properties of individual electrons with microscopic precision (~100nm), manipulate their quantum states, and image their individual wavefunctions. This new toolset will be used to study previously unexplored realms in condensed matter physics, ranging from the correlated states-of-matter formed by electrons in one-dimension, to quantum information experiments with multiple electronic spins, and finally to mechanical studies of nanotube resonators in the quantum limit. These studies will

address some of the most fundamental aspects pertaining to the physics of electrons, spins and phonons in low dimensions.

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**NBR: 258775** **ACRONYM: EMERGE** **EC FUND: 1500000**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE5

**Title:** Enzyme Driven Molecular Nanosystems

**Abstract:** Functional nanomaterials are predicted to have an enormous impact on some of the most pressing issues of 21st century society, including next-generation health care and energy related technologies. Bottom-up approaches, using self-assembly principles, are increasingly considered to be the most appropriate routes for their synthesis. Indeed, Science magazine highlighted How far can we push chemical self-assembly? as one of the 25 biggest questions that face scientific inquiry over the next quarter century. Despite significant advances in recent years, it is still a major challenge to access precisely defined nano-structures in the laboratory, especially if these do not represent the global free energy minimum (i.e. are asymmetric, multifunctional, compartmentalized and/or dynamic). The biological world provides numerous outstanding examples of highly complex functional nano-scale architectures with attractive features such as defect repair, adaptability, molecular recognition and programmability. It is the objective of this ERC Starting Grant to develop and exploit the concept of (bio-)catalytic self-assembly, a bio-inspired approach for bottom-up synthesis of complex nanomaterials. We will explore three unique features of these systems (i) spatiotemporal control, (ii) catalytic amplification, either towards or away from equilibrium and the tempting vision of (iii) dynamic systems with emergent properties. In our approach we aim to encompass the entire spectrum from fundamental understanding to eventual societal benefit. Alongside the fundamental aims, we wish to put our methodologies to use, in collaboration with experts in these fields, to develop novel functional materials towards applications in next-generation biomaterials and gel-phase supramolecular (opto-) electronic materials.

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**NBR: 258782** **ACRONYM: GENEPHYSCHEM** **EC FUND: 1450320**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE5

**Title:** Spatio-temporal control of gene expression by physico-chemical means: from in vitro photocontrol to smart drug delivery

**Abstract:** We propose to undertake a new challenge: the control of gene expression systems by physico-chemical means to achieve the following objectives: i) developing robust tools

for spatio-temporal control of protein expression; ii) understanding the role of micro-environmental factors in gene regulation; and iii) constructing and implementing in vivo smart nanomachines able to express active molecules in response to a stimulus and deliver them to a targeted cell. First, various biochemical processes (transcription, translation) will be controlled by light in vitro, based on photo-induced conformational changes of nucleic acids (DNA, RNA) and chromatin. Based on conformational changes rather than specific template-protein interaction, and combined with microfluidic methodologies, this novel approach will provide a ubiquitous tool to address gene expression using light regardless of the sequence, with unique control and spatio-temporal resolution. Second, by reconstituting photo-responsive gene expression systems in well-defined giant liposomes, we will study the dynamics of gene expression in response to light stimulation. This will allow us to establish the respective roles of the membrane (surface charge, permeability) and of the inner micro-environment composition (viscosity, molecular crowding). Third, we will develop stable, long-circulating polymer nanocapsules (polymersomes) encapsulating a gene expression material that can be triggered by light and/or molecules of biological interest. In response to the signal, an exogenous, potentially immunogenic enzyme will be expressed inside the protecting nanocapsule to locally and catalytically convert a non toxic precursor present in the medium into a cytotoxic drug that will be delivered to a cell (e.g., a cancer cell). This new concept of triggerable gene-carrying nanomachines with unique amplification capacity of drug secretion shall open new horizons for the development of smart biological probes and future therapeutics.

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**NBR: 258806** **ACRONYM: CHEMHEAT** **EC FUND: 1499999**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE4

**Title:** Chemical Control of Heating and Cooling in Molecular Junctions: Optimizing Function and Stability

**Abstract:** Nanoscale systems binding single molecules, or small numbers of molecules, in conducting junctions show considerable promise for a range of technological applications, from photovoltaics to rectifiers to sensors. These environments differ significantly from the traditional domain of chemical studies involving molecules in solution and the gas phase, necessitating renewed efforts to understand the physical properties of these systems. The objective of this proposal concerns one particular class of physical processes: understanding and controlling local heating in molecular junctions in terms of excitation, dissipation and transfer. Local heating and dissipation in molecular junctions has long been a concern due to the possibly detrimental impact on device stability and function. More recently there has been increased interest, as these processes underlie both spectroscopic techniques and potential technological applications. Together these issues make an investigation of ways to chemically control local heating in molecular junctions timely and important. The proposal objective will be

addressed through the investigation of three challenges: - Developing chemical control of local heating in molecular junctions. - Developing chemical control of heat dissipation in molecular junctions. - Design of optimal thermoelectric materials. These three challenges constitute distinct, yet complementary, avenues for investigation with progress in each area supporting the other two. All three challenges build on existing theoretical methods, with the important shift of focus to methods to achieve chemical control. The combination of state-of-the-art computational methods with careful chemical studies promises significant new developments for the area.

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**NBR: 258868** **ACRONYM: LCAOS** **EC FUND: 4140174**

**DG:** RTD **Call: FP7-HEALTH-2010-two-stage** **Thema:** HEALTH.2010.1.2-1

**Title:** A Nanoscale Artificial Nose to easily detect Volatile Biomarkers at Early stages of Lung Cancer and Related Genetic Mutations

**Abstract:** The LCAOS project will develop and test a new diagnostic tool, able to detect: (i) the presence of lung cancer (LC), and (ii) an increased risk of a patient developing LC in the future. Diagnostic tests currently available are unsuitable for widespread screening because they are costly, occasionally miss tumours, are not time-efficient, nor free of complications. LCAOS will overcome these problems by using an approach based on volatile biomarkers emitted from cell membranes. A multidisciplinary effort, incorporating nanotechnology, biomedical engineering, medical oncology, and computation strategies, will develop a highly-sensitive, inexpensive, and fast-response, non-invasive, artificial nose (known as, NaNose), building on the coordinator's earlier success in this area. The NaNose will be able to detect pre-neoplastic volatile biomarkers that indicate an increased genetic risk of LC, and the presence of LC. It has already been established that these biomarkers can be detected either directly from the headspace of the cancer cells or via exhaled breath. LCAOS will: (i) develop arrays of chemically-sensitive field effect transistors (FETs) of non-oxidized, molecule-terminated silicon nanowires (Si NWs); (ii) test the ability of these devices to sense volatile LC biomarkers from in-vitro tissue, and exhaled human breath; (iii) study the signal transduction mechanism of the volatile biomarkers, using pattern recognition; (iv) improve systems to enable the NaNose to distinguish the targeted biomarkers from environmental clutter, using methylation, expression profiling, and genome-wide sequencing; and (v) perform clinical-related studies to assess LC conditions in actual patients & tissues, and in the presence of real-world confounding signals. Validation will be carried out by clinician partners and professional mathematicians and computer scientists. Resources will also be allocated to ensure the commercial potential of the sensor device layout.

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**NBR: 259014** **ACRONYM: MOSAIC** **EC FUND: 1499000**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE5

**Title:** Patterning the surface of monolayer-protected nanoparticles to obtain intelligent nanodevices

**Abstract:** While chemical science is still striving in the search for such molecular machinery, real and perfectly working molecular machines have been developed millions of years ago by Nature. When biological systems are considered, one striking feature that emerges is their intrinsic functional simplicity, since only a few building blocks are used to build complex structures. Apparently, what matters is not chemical complexity but the ability to precisely control the spatial arrangement and organization. Functional nanoparticles offer an unmatched opportunity to build complex structures with simple building blocks and relatively simple manipulations. The main goal of the Mosaic project is to gain the ability to hierarchically control the self-assembling of metal nanoparticles coating monolayers and take advantage from such ability to obtain complex function from the materials realized. This objective will require reaching a complete understanding of the structure and dynamic of nanoparticles coating monolayers developing new tools, mainly based on NMR spectroscopy, for their investigation. Then, we plan to learn how to use supramolecular interactions to control the monolayer organization and to gain, in this way, the ability to program functional groups patterns on the surface of the particles. In this way, it will possible to achieve a degree of organization comparable to that of biologic systems, such as enzymes or membranes. This organization of functional groups will be then used to obtain highly sophisticated function by these nanosystems, such as recognition, sensing, in particular NIR sensing, catalysis and transport.

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**NBR: 259033** **ACRONYM: NANOSPEC** **EC FUND: 1454400**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE3

**Title:** Novel Out-of-Equilibrium Spectroscopy Techniques to Explore and Control Quantum Phenomena in Nanocircuits

**Abstract:** We plan to develop and make use of novel out-of-equilibrium spectroscopy techniques that give access to energy transfers in electronic nanocircuits. The unveiled information will be used to investigate promising quantum phenomena and to explore new routes to control the mechanisms that limit their potentialities for nanoelectronics. The proposals backbone is the spectroscopy of the fundamental electronic states energy distribution function f(E) that we demonstrated this fall 2009: by using a quantum dot as an energy filter, we performed the first measurement of a non-equilibrium f(E) in a semiconductor nanocircuit. We plan not only to employ it, but also to develop complementary techniques which will further widen our range of investigation. We anticipate this f(E) toolbox will be crucial for the rising field of out-of-equilibrium mesoscopic physics. We

will first examine through the unexplored facet of heat transport the quantum Hall effect regimes, which exhibit a large variety of puzzling many-body quantum phenomena and are of particular interest for their metrology applications and quantum information potentialities. The planed experiments will be done for various out-of-equilibrium situations, which will permit us to address longstanding open questions, such as the nature of pertinent excitations, and to test original ways to increase quantum effects. We will also perform direct energy exchange measurements to investigate the inelastic mechanisms that set the length and energy scales of coherent and out-of-equilibrium physics in nanocircuits. The novel f(E) spectroscopy will permit us to take advantage of the two-dimensional electron gas circuits high modularity to study many transport regimes and geometries that remain unexplored from this revealing viewpoint.

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**NBR: 259061** **ACRONYM: HPCNTW** **EC FUND: 1470114**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE8

**Title:** High performance and ultralight carbon nanotube wires for power transmission

**Abstract:** Due to their unique molecular structure carbon nanotubes can offer high electrical conductivity and superior current density. Both of these properties are sought after, especially for overhead power transmission lines where the extremely high axial strength of nanotubes would also be a bonus. In this research proposal single wall carbon nanotubes (nanometer size tubes made of rolled up graphene sheets) with desirable dimensions and controlled way of the graphene sheet rolled up into a tube (referred to as chirality), will be synthesized and spun into fibres using two unique methods, which were developed in Cambridge. These high performance carbon nanotube fibres will be explored as flexible, lightweight, highly efficient materials for use as wires for a variety of power transmission applications. The project will focus on achieving precise chirality control of carbon nanotubes through crystallographic manipulation of the catalyst particles using a recently-discovered in-house method. Tuning the molecular structure of individual nanotubes will achieve maximum uniformity and desired level of electrical conductivity. Next, carbon nanotube fibres will be spun using a unique process currently available only in Cambridge. The quality of fibres will be assessed, after which the fibres will be assembled into strands and cables. In the final stage, different polymeric coatings will be investigated as insulation for the wires and diverse geometries explored. There will be several fundamental benefits from the outcome of this research proposal. Demonstration of the chirality control of nanotubes, which is the “holy grail” in the field, would be important in itself, while application of the material as useful wires and cables will make it much more immediately useful

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**NBR: 259064** **ACRONYM: NANOCAT** **EC FUND: 1500000**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE4

**Title:** Catalysis at the Nanoscale

**Abstract:** Is it possible to really 'see' individual molecules in action as they are involved in a chemical reaction at a surface? And can we, in this way, get a complete understanding of reaction mechanisms, at the resolution of atoms? The importance of studying chemical reactions at surfaces has recently been highlighted by Gerhard Ertl being awarded the Nobel Prize in chemistry in 2007, for elucidating mechanisms of chemical processes on heterogeneous catalysts at the single molecule level with Scanning Tunneling Microscopy (STM). Although ground-breaking, these studies were carried out in ultra-high vacuum, which is, however, an unrealistic condition for conventional chemical or biological reactions which usually occur in a liquid medium. The aim of this ERC proposal is to establish a research area at the interface of chemistry and physics which has so far been nearly completely unexplored: the investigation of chemical reactions at solid-liquid interfaces at the highest detail possible, by visualizing molecules with STM while they are involved in a reaction. By doing so, unique information about reaction mechanisms can be obtained by looking at individual molecules, instead of ensembles where the behaviour of many molecules is averaged. Towards this goal I propose to use a newly developed catalysis-STM setup, which is equipped with a liquid-cell and a bell-jar, and in which the conditions that are commonly applied in chemical laboratory processes (e.g. addition and withdrawal of chemicals, working under different atmospheres) can be closely resembled. In this setup I intend to carry out chemical reactions at a surface and monitor the behaviour of individual adsorbed catalysts, while they are in action. More specifically, it is my aim to investigate in detail the relation between structure and reactivity at the nanoscale

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**NBR: 259068** **ACRONYM: NANOBRAIN** **EC FUND: 1495803**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE3

**Title:** On-chip memristive artificial nano-synapses and neural networks

**Abstract:** These last fifty years have seen Von Neumann computing architectures boom. Nevertheless, even the most powerful digital computers cannot rapidly solve apparently simple problems such as image interpretation. However, because its structure is massively parallel and analog, the human brain is able to perform such tasks in a fraction of second. Neuromorphic circuits allow to go beyond conventional digital architectures. An on-chip implementation of these circuits requires to be able to fabricate nanometer sized, analog, reconfigurable, fast components. While the spiking neurons can easily be

fabricated with classical CMOS technology, the synapse plasticity is challenging to achieve. In 1971 L. Chua has introduced a new circuit element, called memristor , a non-linear resistance which by definition includes a memory effect. Only last year, a team in Hewlett-Packard has for the first time proposed a device for synaptic applications showing memristive properties based on electromigration of oxygen vacancies in Titanium Oxide. The project NanoBrain aims first at developing alternative memristors based on different physical principles (spintronics and ferroelectricity), avoiding in particular the potential over-heating and fragility of the electromigration-based devices. The final goal of the project is to prove the efficiency of these new nano-synapses by integrating them into functional neural networks.

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**NBR: 259076** **ACRONYM: ULPPIC** **EC FUND: 1341600**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE7

**Title:** Ultralow power photonic integrated circuits for short range interconnect networks

**Abstract:** It is now generally recognized that current electrical solutions will not suffice to fulfil all requirements for communication on-chip and between chips, which is expected to continue to grow exponentially during the coming years. Therefore we have to look for alternatives. Optical interconnect is a possibility, which is currently heavily investigated, including in my own on-going research. However, the requirements in terms of power consumption are very stringent and the current solutions being proposed are still off by an order of magnitude. Therefore, the objective of this project is to propose, design, fabricate and characterise photonic devices with fundamental lower power consumption through exploiting a large overlap between optical field, active material and electrical drive signals. For this purpose, we will build a completely new photonics integration platform consisting of self-assembled semiconductor materials as the active core element, embedded within strongly confined photonic cavities defined using the most advanced semiconductor fabrication technologies. Thereby we are combining rapidly maturing bottom-up techniques such as colloidal nanocrystal synthesis and semiconductor nanowire growth with traditional top-down technologies for realizing completely new types of photonic devices with an order of magnitude improvement in device performance. To reach this objective I will build a multidisciplinary team with experts in photonic device design, wet chemical synthesis, solid state physics, epitaxial nanowire growth and microelectronic fabrication technologies.

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**NBR: 259082** **ACRONYM: 2DTHERMS** **EC FUND: 1427190**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE3

**Title:** Design of new thermoelectric devices based on layered and field modulated nanostructures of strongly correlated electron systems

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**NBR: 259141** **ACRONYM: ELECTRONOPERA** **EC FUND: 1419120**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE3

**Title:** Electron dynamics to the Attosecond time scale and Angstrom length scale on low dimensional structures in Operation

**Abstract:** We will develop and use imaging techniques for direct probing of electron dynamics in low dimensional structures with orders of magnitude improvements in time and spatial resolution. We will perform our measurements not only on static structures, but on complex structures under operating conditions. Finally as our equipment can also probe structural properties from microns to single atom defects we can directly correlate our observations of electron dynamics with knowledge of geometrical structure. We hope to directly answer central questions in nanophysics on how complex geometric structure on several length-scales induces new and surprising electron dynamics and thus properties in nanoscale objects. The low dimensional semiconductors and metal (nano) structures studied will be chosen to have unique novel properties that will have potential applications in IT, life-science and renewable energy. To radically increase our diagnostics capabilities we will combine PhotoEmission Electron Microscopy and attosecond XUV/IR laser technology to directly image surface electron dynamics with attosecond time resolution and nanometer lateral resolution. Exploring a completely new realm in terms of timescale with nm resolution we will start with rather simple structure such as Au nanoparticles and arrays nanoholes in ultrathin metal films, and gradually increase complexity. As the first group in the world we have shown that atomic resolved structural and electrical measurements by Scanning Tunneling Microscopy is possible on complex 1D semiconductors heterostructures. Importantly, our new method allows for direct studies of nanowires in devices. We can now measure atomic scale surface chemistry and surface electronic/geometric structure directly on operational/operating nanoscale devices. This is important both from a technology point of view, and is an excellent playground for understanding the fundamental interplay between electronic and structural properties.

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**NBR: 259183** **ACRONYM: SUMOMAN** **EC FUND: 1500000**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE5

**Title:** Supramolecular Cell Manipulation

**Abstract:** Supramolecular chemistry and nanofabrication methods provide excellent prospect to construct reversible dynamic biological nanoplatforms employed for supramolecular cell manipulation (SUMOMAN) experiments. Making use of supramolecular chemistry is a rewarding task in developing functional materials and devices. Knowing the limitations involved in ordering proteins at different length scales will surely hasten the development of future applications, supramolecular nanobiology being the most prominent. The construction of synthetic supramolecular assemblies of proteins provides an excellent tool to fabricate organized bioactive components in the sub-micron regime at surfaces. Supramolecular nanobiology narrows the gap between chemical biology and bionanotechnology. The latter devises ways to construct molecular devices using biomacromolecules and it attempts to build molecular machines utilizing concepts seen in nature. In chemical biology new synthesis methods and strategies are developed and employed for the synthesis of compounds which are used as probes for the study of biological phenomena. Steadily improved synthetic procedures for site-specific modification of proteins have gained more control over structure and function of the proteins. However, applications of protein chips remain hampered by orientational and conformational aspects at the surface. With the development of supramolecular bioactive nano-platforms on surfaces serving as a reversible dynamic interface to cells, the goal to study and manipulate cellular processes will come closer. An innovative construction process of biological nanoarrays is proposed to study important fundamental aspects of cell biology. When such structured surfaces display a biological interface with nm resolution, a lengthscale inherently more relevant to biorecognition than microlengthscales, the communication through biomolecules with cellular receptors can be modulated with unprecedented spatial and temporal specificity.

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**NBR: 259196** **ACRONYM: PLASMOLIGHT** **EC FUND: 1146495**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE2

**Title:** NEW FRONTIERS IN PLASMON OPTICS: FROM NANOCHEMISTRY TO QUANTUM OPTICS

**Abstract:** At this point in time where plasmon optics has become a mature field of research, we propose here to create new bridges with other scientific disciplines in which the optical properties of plasmonic nanostructures could successfully address major roadblocks. The proposed scientific project consists of two independent parts, in which plasmonics is combined with Nanochemistry and Quantum optics, respectively. First, we will investigate how plasmonics could contribute to control with nanometer accuracy the deposition of a wide range of molecules or other nano-objects at a surface pre-

patterned with noble metal nanostructures. Our approach is foreseen to overpass some of the major limitations of existing methods by combining parallel patterning over large areas with a resolution down to 10nm. Beyond demonstrating the feasibility of this novel approach, we propose to exploit it to increase the sensitivity of bio-chemical plasmonic sensing and surface enhanced Raman scattering. The second part of the project will study the use of the recent concept of plasmon nano-optical tweezers to develop a novel integrated quantum platform. The developed platform will be tested for applications to quantum simulation.

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**NBR: 259204** **ACRONYM: BOTTOM-UP_SYSCHEM** **EC FUND: 1500000**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE5

**Title:** Systems Chemistry from Bottom Up: Switching, Gating and Oscillations in Non Enzymatic Peptide Networks

**Abstract:** The study of synthetic molecular networks is of fundamental importance for understanding the organizational principles of biological systems and may well be the key to unraveling the origins of life. In addition, such systems may be useful for parallel synthesis of molecules, implementation of catalysis via multi-step pathways, and as media for various applications in nano-medicine and nano-electronics. We have been involved recently in developing peptide-based replicating networks and revealed their dynamic characteristics. We argue here that the structural information embedded in the polypeptide chains is sufficiently rich to allow the construction of peptide 'Systems Chemistry', namely, to facilitate the use of replicating networks as cell-mimetics, featuring complex dynamic behavior. To bring this novel idea to reality, we plan to take a unique holistic approach by studying such networks both experimentally and via simulations, for elucidating basic-principles and towards applications in adjacent fields, such as molecular electronics. Towards realizing these aims, we will study three separate but inter-related objectives: (i) design and characterization of networks that react and rewire in response to external triggers, such as light, (ii) design of networks that operate via new dynamic rules of product formation that lead to oscillations, and (iii) exploitation of the molecular information gathered from the networks as means to control switching and gating in molecular electronic devices. We believe that achieving the project's objectives will be highly significant for the development of the arising field of Systems Chemistry, and in addition will provide valuable tools for studying related scientific fields, such as systems biology and molecular electronics.

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**NBR: 259256** **ACRONYM: GLASS** **EC FUND: 1514400**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE10

**Title:** InteGrated Laboratories to investigate the mechanics of ASeismic vs. Seismic faulting

**Abstract:** Earthquakes are potentially catastrophic phenomena that have a huge impact on the environment and society. Understanding the physical processes responsible for earthquakes and faulting requires high quality data and direct observations of the underlying phenomena. However, no direct measurements can be made at depth where earthquakes initiate and propagate. Our knowledge of the mechanical properties of fault zones relies on Earth surface observations and experiments conducted in rock deformation laboratories. Despite recent progress, we have much to learn about the mechanics of earthquakes and the complex and inherently scale-dependent processes that govern earthquake faulting. Central Italy is a unique test site that can serve as a natural laboratory for the integration of high resolution data gathered from different disciplines. I propose to develop my innovative and multidisciplinary research to unravel the physico-chemico processes responsible for faulting phenomena ranging from aseismic creep to seismic slip. GLASS will aim to: (i) locate and analyze different types of transient seismic signals from the actively deforming crust, such as fast/slow and high/low frequency earthquakes and non volcanic tremors; (ii) study deformation processes in outcrops of ancient faults that represent exhumed analogues of the active structures today; (iii) characterize the fluid flow and frictional properties of faults in rock deformation experiments; (iv) investigate earthquake nucleation and recurrence by developing numerical models that will be constrained by field and experimental data and calibrated by seismological records. The proposed research will allow to create unprecedented insight into the mechanics of earthquakes and to investigate deformation processes from the crustal to the nano-scale and from a time window ranging from the seismic cycle to entire geologic fault history.

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**NBR: 259286** **ACRONYM: CCCAN** **EC FUND: 1468960**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE4

**Title:** Characterizing and Controlling Carbon Nanomaterials

**Abstract:** The aim of this project is to understand and control the fundamental physical properties of novel carbon nanomaterials: carbon nanotubes and graphene. By a combination of complementary methods, i.e. vibrational spectroscopy, scanning probe microscopy, and theoretical modelling, a comprehensive understanding of the electronic, vibrational, optical properties, and their connection with the material's structure will be obtained. A diagnostics "toolbox" will be established on the materials in their most unperturbed, ideal states. Taking the results as reference, the materials will be studied under conditions relevant when incorporated into devices. These include imperfections of the materials and interaction with different environments, with other carbon

nanotubes/graphene, and with extrinsic materials introduced during device processing. The gained insight and understanding on a fundamental level will also advance technological routes for scaling up carbon-nanomaterial electronic device fabrication, which is still lacking sufficient control over selectivity towards the desired physical properties. Control over the electronic and optical properties will be sought through deliberately induced interactions and chemical functionalization of the materials. The project benefits from close collaborations between experimental and theoretical physics, chemistry, and materials science.

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**NBR: 259297** **ACRONYM: MAGNETALS** **EC FUND: 1499725**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE8

**Title:** Tunable array of magnetic nano-crystals designed at the atomic scale: engineering high performance magnetic materials using hybrid organic-inorganic nano-architectures

**Abstract:** The storage density of computer hard drives is growing so rapidly that for new computer drive generations not only optimized materials are needed but also new concepts for data storage. Last decades, higher storage densities on computer disks were achieved by optimization of magnetic materials, i.e. the magnetic grains were gradually shrunk while, at the same time, the magnetic stability was increased. The nowadays smallest storage unit is made up 100 to 600 grains, that form one bit. Each grain is about 10 nanometres in size. These grains are arranged next to each other on substrates that are plated with magnetic metals. Decreasing further the size and amount of the grains necessary for one bit is now irremediably affecting the signal/noise ratio, weaker signals leading to loss of information. Therefore, new concepts for magnetic storage media have to be found. Material reduced size leads to novel properties totally different from bulk properties. In our project we will engineer matter at the atomic and molecular level and develop advanced construction methods to build new functionalised materials for magnetic storage. We propose a multidisciplinary research project, that aims to explore various aspects related to magnetic properties of highly organised organic-inorganic nano-architectures. We will engineer tunable supramolecular assemblies to host and organise inorganic shape-selected magnetic nanocrystals. Due to the sensitive interrelation of magnetism and the atomic structure of these systems, any induced nanostructure modification will result in changes of the magnetism. Our ability to tailor nanocrystal size, composition, structure, shape and position will allow us to tune magnetism at the atomic scale. We will thus be able to design and produce new high density hybrid nano-architectures having gigantic magnetic performance, i.e., huge magnetostatic energy stored and a high blocking temperature. This research therefore has the potential to make a considerable impact on the high density data storage industry

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**NBR: 259312** **ACRONYM: OPTIMLIGHTHARVEST** **EC FUND: 1427000**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE5

**Title:** Large Scale Architectures with Nanometric Structured Interfaces for Charge Separation, Transport and Interception

**Abstract:** This research is aimed at developing new architectures at the molecular, nanometric, and macroscopic scales for the design and study of light induced charge transport using synthetic systems. The strategic objective is to establish a comprehensive approach for constructing nanometric scale hybrid structures that will enable us to tune the required physical, chemical, and electrical properties across scales required for efficient harvesting of light energy in a rigorous manner for enhancing our capabilities and basic understanding of light harvesting processes. We will form nanometric architectures featuring molecular diversity and functionality with nanometric gaps coupled to scaffolds capable of electrical transport. The nanometric architectures will be formed via simple yet powerful methods relying on sophisticated use of nanostructure surface chemistry and material properties while minimizing the application of top-down fabrication methods and will be studied at the single building block level as well as at array level. Meticulous study of the light induced charge separation and transport at the nanometric scale using single nanostructure building blocks as well as the collective dynamics of large scale arrays will be addressed with an emphasis on understanding charge dynamics at interfaces. The research activity will utilize unique nanostructure assembly methods and post-growth manipulation of the chemical composition developed during my research. Achieving our fundamental goals is expected to lead to new insights and capabilities relating to the harvesting of light energy and converting it to electrical energy and to significantly advance our ability to utilize light energy for photocatalysis.

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**NBR: 259370** **ACRONYM: BIOMIM** **EC FUND: 1499996**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE5

**Title:** Biomimetic films and membranes as advanced materials for studies on cellular processes

**Abstract:** The main objective nowadays in the field of biomaterials is to design highly performing bioinspired materials learning from natural processes. Importantly, biochemical and physical cues are key parameters that can affect cellular processes. Controlling processes that occur at the cell/material interface is also of prime importance to guide the cell response. The main aim of the current project is to develop novel functional bio-nanomaterials for in vitro biological studies. Our strategy is based on two related

projects. The first project deals with the rational design of smart films with foreseen applications in musculoskeletal tissue engineering. We will gain knowledge of key cellular processes by designing well defined self-assembled thin coatings. These multi-functional surfaces with bioactivity (incorporation of growth factors), mechanical (film stiffness) and topographical properties (spatial control of the film s properties) will serve as tools to mimic the complexity of the natural materials in vivo and to present bioactive molecules in the solid phase. We will get a better fundamental understanding of how cellular functions, including adhesion and differentiation of muscle cells are affected by the materials s surface properties. In the second project, we will investigate at the molecular level a crucial aspect of cell adhesion and motility, which is the intracellular linkage between the plasma membrane and the cell cytoskeleton. We aim to elucidate the role of ERM proteins, especially ezrin and moesin, in the direct linkage between the plasma membrane and actin filaments. Here again, we will use a well defined microenvironment in vitro to simplify the complexity of the interactions that occur in cellulo. To this end, lipid membranes containing a key regulator lipid from the phosphoinositides familly, PIP2, will be employed in conjunction with purified proteins to investigate actin regulation by ERM proteins in the presence of PIP2-membranes.

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**NBR: 259374** **ACRONYM: SYLO** **EC FUND: 1230000**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE3

**Title:** Spin dynamics and transport at the quantum edge in low dimensional nanomaterials

**Abstract:** Sustainable development in information technology calls for an ever increasing information processing and storage capability. A promising route to maintain exponential growth capability, i.e. to keep on the Moore's roadmap, is to turn to the electron spins as information carriers rather than their charge. This field, spintronics, has enormous potential whose exploitation requires solid knowledge in the fundamentals of spin dynamics and spin transport. Herein, novel nanomaterials are suggested for spintronics purposes, such as graphene and single-wall carbon nanotubes (SWCNTs). These, fundamental two- and one-dimensional carbon allotropes are promising candidates for such purposes, carbon being a light element with a low spin-orbit coupling which results in a long spin coherence. There are several fundamental open issues, e.g. the dominant spin orbit coupling mechanism in graphene, whether bulk electron spin resonance can be observed for this material, and the length of the spin diffusion length. For SWCNTs, the ground state of isolated metallic tubes is known to be the Tomonaga-Luttinger liquid (TLL), which greatly limit the spin coherence, but it is at present open whether this state is destroyed when an ensemble of interacting metallic tubes is studied. The decay time and spin symmetry of optical excitations (excitons) in semiconducting SWCNTs is yet unknown. Our goal is to pursue electron spin resonance in graphene and carbon nanotubes and to perform optically detected magnetic resonance in carbon nanotubes. We will commission a magnetoptical spectrometer with

a substantial added value. The expected results are characterization of spin transport capabilities of these materials and understanding of the spin decoherence mechanisms. The PI leads magnetic resonance studies of these materials, shown by his more than 300 citations to this field (the total being over 470) and his 15 Physical Review Letters papers in this field (of which for 9 he is main Author).

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**NBR: 259398** **ACRONYM: PORABEL** **EC FUND: 1439840**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE3

**Title:** Nanopore integrated nanoelectrodes for biomolecular manipulation and sensing

**Abstract:** In this proposal we aim to address several complex biophysical problems at single molecule level that remained elusive due to the lack of appropriate experimental approach where one could manipulate independently both interacting biomolecules and in the same time measure the strength of their interaction and correlate it with their electronic signature. In particular we are interested in finding out how biopolymer finds, enters and translocates nanopore. Equally intriguing is still unresolved mechanism of phage DNA ejection. We will also investigate how exactly proteins recognize the target binding places on DNA and if the protein DNA recognition is based on the complementarity of their charge patterns. To allow addressing those biophysical problems we will develop novel experimental framework by integrating electrodes to the nanopore based force spectroscopy. The proposed strategy will enable two directions of the research: single molecule manipulation and single molecule detection /sensing equally suitable for investigating complex biophysical problems and molecular recognition assays. By exploiting superior sensing and detection capabilities of our devices, we will investigate following practical applications improved nucleotide detection, selective protein detection and protein charge profiling via nanopore unfolding. Unique combination of optical manipulation and nanofluidics could lead to new methods of bioanalysis, mechanical characterization and discrimination between specific and non-specific DNA protein interactions. This research proposal combines nanofabrication, optics, nano/microfluidics, electronics, computer programming, and biochemistry

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**NBR: 259419** **ACRONYM: ESKIN** **EC FUND: 1499737**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE7

**Title:** Stretchable Electronic Skins

**Abstract:** Future electronic systems will be soft and elastic. I propose to explore the materials, technology and integration of stretchable electronic systems, which will transform at will, evenly coat a spherical lens, or smoothly interface with a delicate biological organ. Electronics will be anywhere as well as everywhere. The proposed programme has the potential to emulate yet another revolution in the microelectronics industry and trigger transformations in the biomedical sector. The ESKIN programme is an ambitious and highly interdisciplinary endeavour requiring expertise at the frontier of engineering, material sciences, biotechnology and neuroscience. Stretchability in an electronic system is its ability to negotiate mechanical deformations without letting them interfere with its electrical functionality. This is a novel and challenging demand on electronic device technology, which has, to date, mainly pushed for smaller scale fabrication and increased performance. Furthermore the natural compliance of biological tissues and cells calls for softer electronic biomedical interfaces. Overcoming the hard to soft mechanical mismatch will, without doubt, open up new horizons in biomedical research and its related industries. The manufacture of stretchable electronic skins will then require working out the underlying science and technology for active device materials on soft, elastic substrates. This capability will further be implemented to demonstrate various soft and elastic electronic systems ranging from stretchable displays to long-term neural implants. My philosophy is to exploit as much as possible current micro/nanofabrication techniques available for hard surfaces but to tailor them to soft surfaces , optimizing and improving them where needed, in order to ensure rapid transition to worldwide distributed consumer and healthcare products.

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**NBR: 259432** **ACRONYM: MULTIBIOPHOT** **EC FUND: 1394679**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE4

**Title:** Multiphoton processes using plasmonics towards advanced nanobiophotonics

**Abstract:** Proposal summary Biophotonics is an emerging interdisciplinary field. Modern laser spectroscopic methods in combination with microscopy open up exciting new ways to study biological objects. For biological applications, multi-photon or non-linear spectroscopy can offer several advantages over one-photon excitation. The aim of this project is to explore novel spectroscopic strategies based on multi-photon excitation. In order to overcome lowsignal problems related to multi-photon spectroscopy, we will exploit plasmonics and perform multi-photon spectroscopy in the enhanced local optical fields of gold- and silver nanostructures. I propose a combination of three different plasmonics-enhanced two-photon spectroscopic methods for multimodal two-photon sensing and imaging. This combination can provide information on morphological structures and function of biological systems along with chemical information about molecular composition, structure, and interactions. A key aspect of this new concept will be the implementation of spectroscopically multifunctional nanosensors with plasmonic nanoparticles as basic building blocks. Following multi-photon excitation, these sensors

deliver information on their environment inferred from a set of multiple surface-enhanced spectroscopic signatures. The proposed research will generate fundamental knowledge about multi-photon driven processes in enhanced local optical fields and about multi-photon interaction of light and biological matter. This might open up entirely new directions to advance nanobiophotonics. In particular, the outcome of the research will stimulate the new field of two-photon sensing and imaging, which has the capability to advance our understanding of biological systems and processes. The project is expected to have broad impact and contribute to the development of multi-photon optical sensing and multi-photon excited photophysics and photochemistry with applications in physics, chemistry, energy technology, biotechnology and medicine.

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**NBR: 259608** **ACRONYM: THEOFUN** **EC FUND: 1409400**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE4

**Title:** Theoretical studies on the functionalisation of metal surfaces with organic and biological complexes under electrochemical conditions

**Abstract:** The aim of this project is to understand the mechanisms behind the functionalisation of metal surfaces with organic and biological complexes under realistic electrochemical conditions. Focusing on low-index surfaces of gold and platinum, which are also the electrodes in corresponding experiments, we will use a series of theoretical methods applicable for different time- and lengthsscales to investigate the geometry and electronic properties of different complexes attached to these electrodes as function of the surrounding (e.g. electrolyte) and the environmental conditions: temperature, pressure/concentrations, and electrode potential. As complexes we will consider small organic molecules such as 4-mercaptopyridine, 4-ATP, or alkane-chains of variable length, as well as biological complexes, i.e. DNA-sequences. Within the first step we will establish a deeper understanding of how these complexes interact with the metal electrodes and how adlayer structures can be manipulated by applying specific temperature, pressure, or potential-conditions. Since the intermolecular interactions are rather weak, the presence of the external electrode potential could lead to drastic changes of the interfacial morphology. In this respect, particular attention will be spend to the highly-reversible folding and unfolding of DNA-sequences, which has recently had been realized experimentally. Based on thus functionalized electrode surfaces, we will investigate their potential as templates for growing nanoparticles of desired size and shape, which would allow for bridging the gap between well-defined single crystal surfaces and nanoparticles. It is now a matter of establishing the predictive capacity for these methods, an expansive process that itself will open new doors of research.

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**NBR: 259619** **ACRONYM: PHOTO-EM** **EC FUND: 1381541**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE4

**Title:** Solar cells at the nanoscale: imaging active photoelectrodes in the transmission electron microscope.

**Abstract:** The exploitation of renewable sources of energy is one of the biggest challenges of our time, with wide ranging implications in both Science and Society. The new generation of dye-sensitized solar cells and hybrid polymer-inorganic solar cells represents one of the most exciting developments in this field. These promising devices based on photoactive nanomaterials can be produced at low cost, but they have an overall power conversion efficiency of 10-12%, attributed to short charge carrier recombination times and diffusion lengths. If we hope to improve this performance we must learn how the solar cells behave at the nanoscale, under realistic working conditions. To achieve this I propose to study photovoltaic materials in the transmission electron microscope, under photon irradiation. The three main areas to pursue are: a) In situ illumination technique development, b) Study of physical properties of solar cells, c) Theoretical interpretation of the spectroscopy results. The work plan of this ERC project will follow different strands in parallel, so that we can explore this novel field more efficiently. Our in situ illumination technique will be exported to a new monochromated and aberration corrected transmission electron microscope with very high spatial and energy resolution. The ultimate challenge is to provide maps of the electronic properties and photovoltaic behaviour of a solar cell, in particular to evaluate –on the atomic level- the effect of grain boundaries and surfaces on the performance of the device. We will study both dye-sensitized and bulk heterojunction solar cells, starting from the individual nanostructured components, with the aim of producing working cross-section devices to be mounted and operated inside the electron microscope. Efficient data processing and theoretical interpretation of the microscopy results will be essential to the success of this process, so we will build capabilities in these areas to support and guide the experimental work. The team I want to lead in this scientific mission is ideally composed of a postdoctoral research assistant and two PhD students. The postdoc will take care of technique development and theoretical aspects, while the students will concentrate on the study of materials and devices.

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**NBR: 259640** **ACRONYM: SINGLESENS** **EC FUND: 1510000**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE4

**Title:** Single metal nanoparticles as molecular sensors

**Abstract:** Optical spectroscopy of single plasmonic nanoparticles (NPs) has evolved into a recognized tool for nanoscopic sensing applications, using the sensitivity to the NP's environment,charge, size, shape, and proximity to other NPs. Here, I propose taking

advantage of the nanoparticle s minuscule size approaching molecular dimensions in novel ways. Single particle plasmon sensors are in many ways the smallest possible giving unprecedented access to molecular events. The small size amplifies fluctuations by molecular events, allows massive parallel detection of analytes within tiny devices, and to monitor single nanoparticle formation and electrochemical surface reactions in real time. The objective of this project is therefore to develop and explore single-particle plasmon spectroscopy as a novel tool to study such molecular processes. The objective will be reached by (1) building three new setups progressing far beyond current technology and increasing time resolution, spectral sensitivity, and parallelization capability many orders of magnitude, (2) synthesizing nanoparticles with optimal plasmon sensing properties, and (3) simulating plasmon properties to guide the experiments and understand the physics behind the observed phenomena. The single-particle plasmon spectroscopy technique will be applied in four scientific directions to demonstrate its potential: (4) analyzing distance fluctuations of particle pairs linked by (bio-)polymers, (5) recording coverage fluctuations of biomolecules bound to nanoparticles, (6) demonstrating parallel detection of many analytes in multiplexed microfluidic devices, and (7) following particle formation and chemical reactions in a single particle reactor . Single-particle plasmon spectroscopy has the potential to provide a revolutionary new tool to study molecular processes and to become a major commercial analytical tool, especially for pharmaceutical research and development.

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**NBR: 259709** **ACRONYM: X-CITED!** **EC FUND: 1125960**

**DG:** ERCEA **Call: ERC-2010-StG_20091028** **Thema:** ERC-SG-PE3

**Title:** Electronic transitions and bistability: states, switches, transitions and dynamics studied with high-resolution X-ray spectroscopy

**Abstract:** We propose to study transition metal compounds of uncommon transport properties and excitation characteristics applying emerging high-resolution X-ray spectroscopy. The objective is to determine the microscopic origin of the unconventional behaviour of systems with strong electron correlation through systematic investigations, as well as to reveal bistability conditions and excitation characteristics of switchable molecular systems. The main techniques involved are synchrotron radiation (SR)-based spectroscopies, which can explore the fine details of the electronic structure. Besides using existing end stations of SR facilities, we plan to build a portable spectrometer that can be advantageously used both in a laboratory (e.g., with a radioactive source) and at specially dedicated beamlines of SR facilities, in order to benefit from their specializations in extreme conditions and advanced sample environments, in particular unconventional experiments. This spectrometer should also be able to work in a time-resolved mode so that it could address the dynamics of electronic excitations on the attosecond to nanosecond time scale. The suggested work is expected to push high-

resolution X-ray spectroscopies toward maturity, which should open up new horizons in electronic structure and dynamics studies of condensed matter research.

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**NBR: 260056** **ACRONYM: NANOPCM** **EC FUND: 2399652**

**DG:** RTD **Call: FP7-2010-NMP-ENV-ENERGY-ICT-EeB** **Thema:** EeB.NMP.2010-1

**Title:** New Advanced iNsulatiOn Phase Change Materials

**Abstract:** The overall objective of NANOPCM is the development, implementation, production, and demonstration of low cost and improved Phase Change Materials for new high performance insulation components in existing buildings. For this purpose, different technical innovations will be carried out during this project: 1. New low cost stable thermal storage component based on the anchorage at nanoscale of organic PCMs between the polymeric chains of selected polymers. The PCMs will be based on by-products of different industries. 2. New thermal insulation inorganic nanofoam with thermal storage capacity by the impregnation with inorganic or organic phase change materials. The nanoporous material will help to improve the thermal behaviour of the PCM and the innovative use of hydrated salts (inorganic PCM) in construction materials. 3. Improve the thermal behaviour of the materials developed with the introduction of high thermal conductive nanomaterials, CNT or CNF inside their structures. 4. Improved organic phase change microcapsules with the incorporation of high thermal conductive nanomaterials, CNT or CNF in the shell which will provide better thermal transfer to the organic paraffin inside. The objectives of this project will be achieved through 8 WP´s. WP1 is dedicated to project management, WP2-WP3 are related to the experimental development of the new materials and its characterization, WP5 to the study of the Life Cycle, the recycling possibilities and the minimization of the process cost. Finally, in WP4, WP6, WP7 and WP8 will be dealing with the validation, demonstration and dissemination of the results.

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**NBR: 260086** **ACRONYM: NANOINSULATE** **EC FUND: 4357545**

**DG:** RTD **Call: FP7-2010-NMP-ENV-ENERGY-ICT-EeB** **Thema:** EeB.NMP.2010-1

**Title:** Development of Nanotechnology-based High-performance Opaque & Transparent Insulation Systems for Energy-efficient Buildings

**Abstract:** NANOINSULATE will develop durable, robust, cost-effective opaque and transparent vacuum insulation panels (VIPs) incorporating new nanotechnology-based core materials (nanofoams, aerogels, aerogel composites) and high-barrier films that are up to four times more energy efficient than current solutions. These new systems will

provide product lifetimes in excess of 50 years suitable for a variety of new-build and retrofit building applications. Initial building simulations based on the anticipated final properties of the VIPs indicate reductions in heating demand of up to 74% and CO2 emissions of up to 46% for Madrid, Spain and up to 61% and 55% respectively for Stuttgart, Germany for a building renovation which reduces the U-value of the walls and roof from 2.0 W m-2 K-1 to 0.2 W m-2 K-1. This reduction could be achieved with NANOINSULATE products that are only 25 mm thick, giving a cost-effective renovation without the need of changing all the reveals and ledges. Similarly, significant reductions in U-values of transparent VIPs (3 W m-2 K-1 to 0.5 W m-2 K-1) are shown by substituting double glazed units in existing building stock. Six industrial & four research based partners from seven EU countries will come together to engineer novel solutions capable of being mass produced. Target final manufacturing costs for insulation board (production rates above 5 million m2/year) are less than €7 m-2 for a U-value of 0.2 W m-2 K-1. NANOINSULATE will demonstrate its developments at construction sites across Europe. A Lifecycle Assessment, together with a safety and service-life costing analysis, will be undertaken to prove economic viability. NANOINSULATE demonstrates strong relevance to the objectives and expected impacts of both the specific call text of the Public-Private Partnership "Energy-efficient Buildings" topic "New nanotechnology-based high performance insulation systems for energy efficiency" within the 2010 NMP Work Programme and the wider NMP & Energy Thematic Priorities.

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**NBR: 260103** **ACRONYM: FEMTOPRINT** **EC FUND: 2493468**

**DG:** RTD **Call: FP7-2010-NMP-ICT-FoF** **Thema:** FoF.NMP.2010-3

**Title:** FEMTOSECOND LASER PRINTER FOR GLASS MICROSYSTEMS WITH NANOSCALE FEATURES

**Abstract:** FEMTOPRINT is to develop a printer for microsystems with nano-scale features fabricated out of glass. Our ultimate goal is to provide a large pool of users from industry, research and universities with the capability of producing their own micro-systems, in a rapid-manner without the need for expensive infrastructures and specific expertise. Recent researches have shown that one can form three-dimensional patterns in glass material using low-power femtosecond laser beam. This simple process opens interesting new opportunities for a broad variety of microsystems with feature sizes down to the nano-scale. These patterns can be used to form integrated optics components or be 'developed' by chemically etching to form three-dimensional structures like fluidic channels and micro-mechanical components. Worth noticing, sub-micron resolution can be achieved and sub-pattern smaller than the laser wavelength can be formed. Thanks to the low-energy required to pattern the glass, femtosecond laser consisting simply of an oscillator are sufficient to produce such micro- and nano-systems. These systems are nowadays table-top and cost a fraction of conventional clean-room equipments. It is highly foreseeable that within 3 to 5 years such laser

systems will fit in a shoe-box. The proposal specific objectives are: 1/ Develop a femtosecond laser suitable for glass micro-/nano- manufacturing that fits in a shoe-box 2/ Integrate the laser in a machine similar to a printer that can position and manipulate glass sheets of various thicknesses 3/ Demonstrate the use of the printer to fabricate a variety of micro-/nano-systems with optical, mechanical and fluid-handling capabilities. A clear and measurable outcome of Femtoprint will be to be in a situation to commercialize the 'femtoprinter' through the setting-up of a consortium spin-off. The potential economical impact is large and is expected in various industrial sectors.

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**NBR: 260117** **ACRONYM: HIPIN** **EC FUND: 2100000**

**DG:** RTD **Call: FP7-2010-NMP-ENV-ENERGY-ICT-EeB** **Thema:** EeB.NMP.2010-1

**Title:** High Performance Insulation based on Nanostructure encapsulation of air

**Abstract:** The concept of High Performance Insulation Based on Nanostructured Encapsulation of Air (HIPIN), described in this proposal, is to develop a sustainable and affordable technology to produce a nanostructured thermal insulating coating to improve thermal efficiency in new and retrofitting buildings. The insulating material will have enhanced performance compared with the state of the art products and will contribute to the protection of the environment through the reduction of greenhouse gases generated in heating and cooling the building. The concept described in HIPIN develops technology which is affordable and easily applicable. Insulating properties will be achieved through a combination of a novel approach to fabrication of aerogels to address the current cost issue, combined with the addition of low emissivity, a critical feature in improving the performance of thin insulating layers. In addition to the insulating effect, other functionalities will be sought such as self-cleaning, sound insulation and fire retardant properties. The innovative multi-functional material will be suitable for application in a liquid form on exterior of buildings at a reducing cost and time required for installation. This will be achieved by the development of novel technology for handling fragile additives within liquid systems. The developed process will constitute a viable approach to produce a material which can be affordably manufactured on an industrial scale and significantly in advance of solutions currently available.

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**NBR: 260123** **ACRONYM: NANOFOAM** **EC FUND: 1998118**

**DG:** RTD **Call: FP7-2010-NMP-ENV-ENERGY-ICT-EeB** **Thema:** EeB.NMP.2010-1

**Title:** New NANO-technology based high performance insulation FOAM system for energy efficiency in buildings

**Abstract:** The NANOFOAM project consortium is formed by leading and experienced players in the sector of manufacturing innovative chemical products, engineering nanostructured foams and materials, energy efficiency for the Construction sector, Materials Science and advanced modelling and characterization of material properties and thermo-physical processes. Through the proposed RTD and DEMO project they will: • Develop an innovative high-performing nanostructured polymeric foam, employing a low GWP blowing agent such as CO2 and having a lower thermal conductivity and superior properties (mechanical, fire resistance, moisture/fungi resistance) than commercial insulation products at a competitive price. • Evaluate and test the compliance of this technology with respect to current standards and environmental, health and safety regulations in real scale settings (laboratory rooms or real dwellings). • Assess the full technical, economic and environmental performance of the novel engineered insulation nanofoam for its commercial implementation on the market in new buildings and for retrofitting of old ones. The expected results of the NANOFOAM project have the potential to drastically reduce energy consumption and to decrease CO2 emissions for both new buildings and the renovation of existing assets.

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**NBR: 260132** **ACRONYM: COOL-COVERINGS** **EC FUND: 3000000**

**DG:** RTD **Call: FP7-2010-NMP-ENV-ENERGY-ICT-EeB** **Thema:** EeB.NMP.2010-1

**Title:** Development of a novel and cost-effective range of nanotech improved coatings to substantially improve NIR (Near Infrared Reflective) properties of the building envelope

**Abstract:** Recent work has shown the possibility to drastically increase the reflection performance of the building envelop, using nanotechnologies. Standard metal oxides are already known for their solar reflection properties, but latest developments identified that nanotechnologies can improve Index of Reflectance from an average of 0,35 to 0,85 because of their effectiveness on Near Infrared wavelengths, even on non white surfaces. The NIR reflective COOL-Coverings Project aims to develop an easy to use and cost-effective range of coatings that can be rapidly offered in the market of retrofitting and new constructions: (1) on the external walls; (2) on façades ceramics; (3) on the roofs, for which an already existing new generation membrane will incorporate a nanotechnological-based NIR reflecting coating; (4) on the internal walls and tiles, since the NIR-Reflecting nanocrystalline oxides can be developed in such a reflection range that may also cover the radiation from indoor heating systems. Glazed envelops and windows have not been considered in the scope of the project since several players are already active with a considerable amount of scientific papers. First simulations showed that NIR reflective solutions allow interesting savings in cooling and heating bills, and pay off rapidly the initial investment. The more competitive target will be air-conditioned buildings with flat roof in hot Mediterranean coast, while there is a clear evidence that also buildings in northern continental climates will payoff the additional investment in the NIR technology, due to reflective properties of the internal walls.

**NBR: 260141** **ACRONYM: AEROCOINS** **EC FUND: 3000000**

**DG:** RTD **Call: FP7-2010-NMP-ENV-ENERGY-ICT-EeB** **Thema:** EeB.NMP.2010-1

**Title:** Aerogel-Based Composite/Hybrid Nanomaterials for Cost-Effective Building Super-Insulation Systems

**Abstract:** In the context of global climate control policies, improving the energy efficiency of existing buildings represents a great challenge, worldwide as well as at the European level. Reducing the energy consumption of buildings is nowadays preferably achieved by increasing the thermal resistance of the insulation layer in the building envelope. The AEROCOINs project will make a significant contribution to the future reduction of energy consumption by decreasing heating and cooling demands of existing-buildings. A clever combination of sol-gel science and nanotechnology can greatly advance design and development of novel superinsulating aerogels. The AEROCOINs project proposes to create a new class of mechanically strong superinsulating aerogel composite/hybrid materials by overcoming the two major obstacles which have endured for so long and have prevented a more wide-spread use of silica-based aerogel insulation components in the building industry: i) strengthening of silica aerogels by cross-linking with cellulosic polymers or the incorporation of cellulose-based nanofibres and ii) lowering the production cost of monolithic plates or boards of composite/hybrid aerogel materials via ambient drying and continuous production technology. Acting on these two incentives, new superinsulating aerogel-based monolithic materials with improved thermo-mechanical properties will be synthesized at the laboratory scale, developed further to the pilot scale under the shape of superinsulating panels, integrated in well-suited envelope components which will then be used for energy and ageing evaluation purposes via the integration of the aerogel-based components in a demonstration wall. In addition, a complete LCA study of the component will be realized and a fabrication concept for cost effective mass production (based on a continuous elaboration process) will be laid out for further pre-industrial development

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**NBR: 260174** **ACRONYM: IMPRESS** **EC FUND: 4616297**

**DG:** RTD **Call: FP7-2010-NMP-ICT-FoF** **Thema:** FoF.NMP.2010-3

**Title:** Flexible Compression Injection Moulding Platform for Multi-Scale Surface Structures

**Abstract:** IMPRESS targets the development of a technological injection moulding platform for serial production of plastic components incorporating micro or nano scale functional features. The platform will be based on the gathering of up to date and most advanced

facilities based on three main modules, each of them being a tool box including several building blocks: - a tool manufacturing module involving different technologies of micro-nano direct manufacturing, from top-down to bottom-up such as self-assembling, - an injection moulding module including equipments fitted with up to date hardware to improve replication quality and capability, - an intelligence module dedicated to advanced process control and online metrology integration. Beside this large panel of facilities, three case studies have been selected (biology, health and energy), each of them requiring a specific and well defined surface micro-nano texturation. These case studies cover a very large range of nano-feature (from 100nm up to 1 µm) and component size (from 1 cm2 up to 1000 cm2). They will serve to qualify the capabilities of the different building blocks and will allow (i) to select the most suitable building blocks as of application requirements (ii) to learn about the platform working and (iii) to anticipate the technological future of the platform. Finally, a technico-economic tool for decision making will be developed based on the IMPRESS case studies and thus to allow end-users to select the most appropriate configuration regarding the end product manufacturing requirements. Further to the IMPRESS case studies, the performances of the platform will be validated through a satellite group. IMPRESS technological platform will accelerate the production and the time to market of micro nano-scale functional feature on multi-component devices in order to obtain an important reduction of needed supply chain space, technological risk and manufacturing costs of next generation plastic part products.

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**NBR: 260341** **ACRONYM: DNA-AMP** **EC FUND: 1500000**

**DG:** ERCEA **Call: ERC-2010-StG_20091118** **Thema:** ERC-SG-LS7

**Title:** DNA Adduct Molecular Probes: Elucidating the Diet-Cancer Connection at Chemical Resolution

**Abstract:** Bulky DNA adducts formed from chemical carcinogens dictate structure, reactivity, and mechanism of chemical-biological reactions; therefore, their identification is central to evaluating and mitigating cancer risk. Natural food components, or others associated with certain food preparations or metabolic conversions, initiate potentially damaging genetic mutations after forming DNA adducts, which contribute critically to carcinogenesis, despite the fact that they are typically repaired biochemically and they are formed at extremely low levels. This situation places significant limitations on our ability to understand the role of formation, repair, and mutagenesis on the basis of the complex DNA reactivity profiles of food components. The long-term goals of this research are to contribute basic knowledge and advanced experimental tools required to understand, on the basis of chemical structure, the contributions of chronic, potentially adverse, dietary chemical carcinogen exposure to cancer development. It is proposed that a new class of synthetic nucleosides, devised on the basis of preliminary discoveries made in the independent laboratory of the applicant, will serve as molecular

probes for bulky DNA adducts and can be effectively used to study and AMPlify, i.e. as a sensitive diagnostic tool, low levels of chemically-specific modes of DNA damage. The proposed research is a chemical biology-based approach to the study of carcinogenesis. Experiments involve chemical synthesis, thermodynamic and kinetic characterization DNA-DNA and enzyme-DNA interactions, and nanoparticle-based molecular probes. The proposal describes a potentially ground-breaking approach for profiling the biological reactivities of chemical carcinogens, and we expect to gain fundamental knowledge and chemical tools that can contribute to the prevention of diseases influenced by gene-environment interactions.

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**NBR: 260587** **ACRONYM: ACTIVATION OF XCI** **EC FUND: 1500000**

**DG:** ERCEA **Call: ERC-2010-StG_20091118** **Thema:** ERC-SG-LS2

**Title:** Molecular mechanisms controlling X chromosome inactivation

**Abstract:** In mammals, gene dosage of X-chromosomal genes is equalized between sexes by random inactivation of either one of the two X chromosomes in female cells. In the initial phase of X chromosome inactivation (XCI), a counting and initiation process determines the number of X chromosomes per nucleus, and elects the future inactive X chromosome (Xi). Xist is an X-encoded gene that plays a crucial role in the XCI process. At the start of XCI Xist expression is up-regulated and Xist RNA accumulates on the future Xi thereby initiating silencing in cis. Recent work performed in my laboratory indicates that the counting and initiation process is directed by a stochastic mechanism, in which each X chromosome has an independent probability to be inactivated. We also found that this probability is determined by the X:ploïdy ratio. These results indicated the presence of at least one X-linked activator of XCI. With a BAC screen we recently identified X-encoded RNF12 to be a dose-dependent activator of XCI. Expression of RNF12 correlates with Xist expression, and a heterozygous deletion of Rnf12 results in a marked loss of XCI in female cells. The presence of a small proportion of cells that still initiate XCI, in Rnf12+/- cells, also indicated that more XCI-activators are involved in XCI. Here, we propose to investigate the molecular mechanism by which RNF12 activates XCI in mouse and human, and to search for additional XCI-activators. We will also attempt to establish the role of different inhibitors of XCI, including CTCF and the pluripotency factors OCT4, SOX2 and NANOG. We anticipate that these studies will significantly advance our understanding of XCI mechanisms, which is highly relevant for a better insight in the manifestation of X-linked diseases that are affected by XCI.

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**NBR: 260600** **ACRONYM: GLYCOHIT** **EC FUND: 2993056**

**DG:** RTD **Call: FP7-HEALTH-2010-single-stage** **Thema:** HEALTH.2010.1.1-3

**Title:** Glycomics by High-throughput Integrated Technologies

**Abstract:** Protein glycosylation is a post-translational phenomenon that is involved in most physiological and disease processes including cancer. Most of the known cancer-associated glycobiomarkers were discovered individually using liquid chromatography and mass spectroscopy. Though valuable, there is room for improvement in these approaches for the discovery phase. There is also a critical need for innovative, rapid, and high-throughput (HTP) technologies that will translate the discovery of cancer-associated glycobiomarkers from basic science to clinical application. The GlycoHIT consortium brings a highly experienced, innovative and interdisciplinary team of researchers from Europe, China and USA representing academia, industry and clinical fields to significantly enhance some of the existing glycoanalytical technologies and to advance novel HTP glycoanalytical technologies beyond current state of the art. ▪ Microchip technology and novel partitioning methods will be exploited for nanoscale HTP separations of serum glycoproteins for analysis by HPLC or LC–MS. ▪ In parallel, lectin array technology will be radically improved by the innovative use of recombinant human lectins and lectin mimics derived by screening large phage displayed combinatorial libraries. ▪ Aptamer libraries will be exploited for identification of lectin mimics and development of a glycosignature platform ▪ Compatibility of the lectin/lectin mimic array technologies with novel label-free biosensors will be explored. Newly-developed technologies will be validated by analysis of serum samples from a variety of cancer patient cohorts and will be supported throughout by experimental interaction analysis, complex structural modelling and informatics. Effective project management, commercially-aware intellectual property management and targeted dissemination activities supplement the core science and ensure maximum impact for the project.

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**NBR: 260604** **ACRONYM: MUMID** **EC FUND: 1498800**

**DG:** ERCEA **Call: ERC-2010-StG_20091118** **Thema:** ERC-SG-LS7

**Title:** Multimodal tools for Molecular Imaging, Diagnostics and Therapeutics

**Abstract:** Non-invasive imaging techniques allow visualization of the dynamics and biochemical activity of pathological processes in real-time. By having proper molecular tools, a complete picture of pathologic conditions can be acquired at resolutions from the molecular level to the full body scale. Hence, smart multimodal imaging tools can be utilized for a diversity of applications, ranging from fundamental understanding of disease related events to molecular diagnostics of specific diseases. Secondly, molecular scaffolds used for imaging can also be explored as therapeutics for specific diseases, since such scaffolds are directed towards targets involved in the pathological mechanism of the disease. This project aims at developing an alternative concept for molecular

imaging, diagnostics and therapy based on the chemical design of luminescent conjugated oligomeric thiophene derivatives (LCOs) which recognize distinct structural motifs instead of specific biomolecules. The LCO can for instance be utilized for specific labelling of protein aggregates, the pathological hallmark of Alzheimer's, Parkinson's and prion diseases, and for differentiation of distinct cell types, such as stem cells or cancer cells. By combining the LCO technique with other technology platforms, multimodal molecular imaging tools that can be used to gain novel insights regarding fundamental disease related biological mechanisms from the nanoscopic to the macroscopic level will be achieved. The LCO molecular scaffolds will also be evaluated as therapeutically active agents towards pathologic molecular process underlying protein aggregation diseases, bacterial infection and cancer. The main objectives of the project are; • To synthesize a diverse library of novel LCOs specific for disease related molecular targets • To develop novel LCO-hybrid materials for multimodal real time in vivo imaging of biological and pathological processes from the nanoscopic (molecular, cellular) to the macroscopic level (body, organ) • To utilize the novel real-time imaging probes for studying the pathological or biological processes associated with certain diseases, including protein aggregation diseases, such as Alzheimer's and Parkinson's diseases, bacterial infection and cancer. • To explore LCO and LCO-based pharmacophores as therapeutics towards pathological molecular process involved in protein aggregation diseases, bacterial infection and cancer. The main focus of the project is to synthesize novel molecular tools but the project has a multidisciplinary research approach and involves research disciplines such as organic chemistry, physics, biochemistry and medicine. The purpose is to provide real-time in vivo imaging agents that can be utilized for studying both the nanoscopic molecular mechanism and the macro-pathology of a diversity of biological events. In addition, the same molecular scaffold will be explored for the development of therapeutic agents. We foresee that the novel multimodal tools will be of relevance to a wide community of researchers and also of great interest to the European health care industry.

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**NBR: 260875** **ACRONYM: NANOMECH** **EC FUND: 1500000**

**DG:** ERCEA **Call: ERC-2010-StG_20091118** **Thema:** ERC-SG-LS3

**Title:** Protein Friction of Molecular Machines: Nanomechanics with Optical Tweezers

**Abstract:** Molecular machines---assemblies of macromolecules, often fueled by nucleotide hydrolysis---are fascinating devices and crucial for driving self-organization in cells. While protein components of many biological machines have been identified, and in many cases their structures have been solved, the mechanical principles that govern the operation of biological machines are poorly understood. For example, how much force can they generate; and what limits their speed and efficiency? These questions have been difficult to answer because the tools needed to study nanometer-sized machines that generate minute forces on the order of piconewtons have not been available until

recently. Friction arises between proteins when they interact by making and breaking weak intermolecular bonds. When a bond breaks, the energy stored in its deformation is dissipated. Protein friction is a useful concept because it provides mechanical insight and allows for quantitative theoretical understanding of the dynamics and energy balance of mechanical cellular processes. In cells, many motor proteins often cooperate to drive motility. I will ask how friction and force-generation arise and scale with the number of motors to elucidate how collective behavior and self-organization emerge. The goals of this interdisciplinary project address the role that protein friction plays in limiting the dynamics and efficiency of microtubule-based motor proteins using a novel, combined optical tweezers and single-molecule fluorescence apparatus. In the long term, I hope that our avant-garde nanotechnological tools will be applicable to other molecular machines and that the studies on microtubule-based motors will shed light on the way that cells use energy to create pattern and order.

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**NBR: 260884** **ACRONYM: SMEN** **EC FUND: 1220473**

**DG:** ERCEA **Call: ERC-2010-StG_20091118** **Thema:** ERC-SG-LS9

**Title:** Single Molecule Enzymology with ClyA Nanopores

**Abstract:** Single molecules based techniques provide the ultimate toolkit to study complex biological systems. In single-molecule approaches, molecules do not need to be synchronised as in ensemble studies, and rare and/or transient species along a reaction pathway as well as heterogeneity and disorder in a sample can be revealed. Observing and manipulating single molecules, however, is generally complicated, time consuming and withstand several technical limitations that hamper the study of single enzymes to a few selected examples. Here I am proposing to develop a new technology to study single native enzymes that is sensitive, simple and inexpensive, and has a temporal resolution ranging from few ¼seconds to hours. Nanopores have been used to detect single molecules and to investigate mechanisms of chemical reactions at the single molecule level. The basic concept of nanopore analysis is to observe, under an applied potential, the disruption of the flow of ions through the pore caused by the interaction of the molecules of interest with a binding site within the pore. Similarly, small enzymes or functional nucleic acids will be attached to the vestibule of a biological nanopore via disulfide bridge or click chemistry. The conformational changes associated with catalysis will then be observed by the altered ionic flow through the pore. In addition, when a charged chaotropic agent is placed on the trans side of the bilayer, the applied potential will allow the directional control of the flow of the chaotropic agent through the pore that, ultimately, also will control the unfolding and refolding of the protein attached to the pore. This will allow investigations of reversible unfolding processes far from equilibrium at the single molecule level for the first time.

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**NBR: 261075** **ACRONYM: ROADTOIPS** **EC FUND: 1359000**

**DG:** ERCEA **Call: ERC-2010-StG_20091118** **Thema:** ERC-SG-LS3

**Title:** Dissection of molecular signature transformation during the process of pluripotency induction

**Abstract:** Induced pluripotent stem cells (iPSCs) are expected to have an enormous impact on medical research. However, the efficiency of reprogramming is still low and far from routine. Nevertheless, reprogramming with defined factors, Oct4, Sox2, Klf4 and c-Myc, is not a random event. Cells positive for SSEA-1, a marker of undifferentiated mouse ES cells (ESC), appear from cells which have lost the fibroblast marker Thy-1, prior to acquiring other pluripotent markers, e.g. Oct4, Nanog. Similarly, TRA-1-60 positive fully reprogrammed human iPSCs appear from SSEA-4 positive populations. Based on these observations, I hypothesize that there are essential ordered stages that the cells must undergo as they are directed toward pluripotency. To explore this hypothesis, I plan to perform three projects: 1. Identifying gene expression signatures during the successful reprogramming process. 2. Investigating serial changes of reprogramming factor binding, chromatin modifications and chromatin structure on the route to a pluripotent state. 3. Functional analysis of the candidate gene(s) identified for successful reprogramming. Based on my latest publication in Nature, I have developed an original highly efficient reprogramming system, in which almost all cells differentiated by retinoic acid treatment generate iPSCs by day 12 post reprogramming factor induction. The homogenous culture allowed by this system enables the unique execution of the objectives above, and for the first time will shed light on the molecular mechanisms of the reprogramming process. Accurate and more informed understanding of these ordered processes will allow derivation of strategies to improve the reprogramming technology.

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**NBR: 261162** **ACRONYM: SIMBA** **EC FUND: 1456374**

**DG:** ERCEA **Call: ERC-2010-StG_20091118** **Thema:** ERC-SG-LS9

**Title:** Single-Molecule BioAssays at Elevated Concentrations

**Abstract:** In order to advance single-molecule fluorescence spectroscopy to the next level, handling and analysis of single molecules has to become broadly available. A further quantum leap is required to proceed to commercially successful applications such as drug screening and medical diagnostics. In this project, I suggest a strategy to overcome the fundamental gap between the nanomolar concentration regime of current optical single-molecule spectroscopy and the nano- to millimolar dissociation constants of typical biomolecular interactions. I will use nano-apertures, which confine the detection

to sub-attoliter volumes and allow single-molecule studies at elevated concentrations. To overcome unspecific binding and deteriorated fluorescence signals in the nano-apertures, I will use tailor-made DNA nanostructures produced by DNA origami. These nanostructures will match the nano-apertures like a plug in a socket. Inserting molecules at programmed positions in the nanostructures will open up a new realm of applications by the ability to immobilize exactly one molecule per nano-aperture and by obtaining comparable signals from every nano-aperture. I will spectroscopically characterize the nano-apertures creating a fluorescence map of their inside. I will exemplarily use the new abilities for previously impossible applications such as several folds improvement of single-molecule DNA sequencing, direct single-molecule RNA sequencing by reverse transcriptase for cancer screening, for paralleled drug screening of HIV protease inhibitors and for studying the chemomechanical coupling of single helicases. In summary, I envision a broadly applicable platform that has the potential to become a golden standard by enabling both ground breaking fundamental research and commercial applications.

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**NBR: 261224** **ACRONYM: DNAMETRY** **EC FUND: 1500000**

**DG:** ERCEA **Call: ERC-2010-StG_20091118** **Thema:** ERC-SG-LS1

**Title:** DNA based nanometry: Exploring chromatin structure and molecular motors

**Abstract:** DNA metabolism is governed by a delicate balance between compacting the stored genetic information while simultaneously ensuring a highly dynamically access to it. This interdisciplinary project aims (i) to understand the mechanics and dynamics of chromatin as well as the mechanism of enzymes involved in DNA metabolism on a molecular level and (ii) to develop new nanometric tools based on optical methods and 3D DNA nanostructures that allow addressing new experimental questions. Within the research project novel nanoscopic detection assays based on the combination of magnetic tweezers and optical methods shall be developed, such as ultra-fast torque spectroscopy and combined FRET-force spectroscopy. Our single-molecule assays shall be applied to study the material properties of self-assembled 3D DNA nanostructures, which shall then be used to set up improved high resolution single-molecule assays. These technological improvements will become key to obtain insight into structure and dynamics of in vitro reconstituted chromatin as response to external mechanical stress but also into the operation of molecular motors that themselves generate forces and torques on DNA and chromatin. The main goal of the project is to use nanotechnological tools to understand design principles of biomolecules, biomaterials and biological motors, which in turn shall be used to develop smarter nanotools and functional elements.

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**NBR: 261507** **ACRONYM: MAPPER** **EC FUND: 2400000**

**DG:** CNECT **Call: FP7-INFRASTRUCTURES-2010-2** **Thema:** INFRA-2010-1.2.2

**Title:** Multiscale Applications on European e-Infrastructures

**Abstract:** Today scientists and engineers are commonly faced with the challenge of modelling, predicting and controlling multiscale systems which cross scientific disciplines and where several processes acting at different scales coexist and interact. Such multidisciplinary multiscale models, when simulated in three dimensions, require large scale or even extreme scale computing capabilities. Progress in science and technology is limited by our ability to solve efficiently such problems on available distributed computing infrastructures. The MAPPER project will respond to this critical need by developing computational strategies, software and services for distributed multiscale simulations across disciplines, exploiting existing and evolving European e-Infrastructure. Driven by seven challenging applications from five representative scientific domains (fusion, clinical decision making, systems biology, nano science, engineering), MAPPER will deploy a computational science environment for distributed multiscale computing on and across European e-infrastructures. By taking advantage of existing software and services, as delivered by EU and national projects, MAPPER will result in high quality components for today's e-Infrastructures. We will advance the state-of-the-art in high performance computing on European e-Infrastructures by enabling distributed execution of multiscale models. We will develop tools, software and services that allow two modes (loosely - and tightly coupled) of multiscale computing, in a user friendly and transparent way. We will integrate our applications into the MAPPER environment, and we will demonstrate their enhanced capabilities by answering one challenging scientific question related to each application. We plan to collaborate with other projects on adaptation of successful MAPPER methodologies, and will work with resource providers to develop policies facilitating the new multiscale computing paradigms.

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**NBR: 261809** **ACRONYM: COMMONSENSE** **EC FUND: 3404935**

**DG:** REA **Call: FP7-SEC-2010-1** **Thema:** SEC-2010.1.3-3

**Title:** Development of a Common Sensor Platform for the Detection of IED "Bomb Factories"

**Abstract:** The detection of IED manufacturing facilities is crucial for the security of citizens, as well as infrastructures and utilities. Current sensing methods suffer from susceptibility to false positive results due to environmental contaminants, or false negative results to interfering compounds. The need exists for a single distributed network, with a common interface and communications protocol, to manage and communicate with a variety of different sensor technologies, and use the combined sensor data to produce clear and

unequivocal results with low false positive/negative readings. The goal of the CommonSense project is to create and demonstrate this sensor network, through the simultaneous and parallel development of novel materials, portable sensors and a wireless communications network, which uses chemometric data processing algorithms to “learn” to recognise trace amounts of explosives, and differentiate them from interferents. The partners will produce a series of novel organic, polymeric and nanocrystalline materials with tuned optoelectronic properties and surface affinities to be used as the active sensor elements. These elements will be incorporated into devices based on optical, electrical, and other readout mechanisms, for detection of airborne and waterborne analytes. The CommonSense project will also incorporate radiation detectors to detect this growing security threat of “dirty bombs”, where sub-critical amounts of radioactive materials, obtained from medical waste or other sources, are incorporated into IEDs. The key point in the use of such a variety of sensor technologies is that no one substance can act as an interferent to all of the sensors, thus reducing false positives and negatives. Eliminating the remaining false readings will be achieved through use of the chemometric algorithms in order to teach itself to recognise the “fingerprint” sensor response to different explosives types and ignore interfering compounds.

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**NBR: 261868** **ACRONYM: MORDRED** **EC FUND: 3624853**

**DG:** RTD **Call: FP7-NMP-2010-SMALL-4** **Thema:** NMP.2010.2.5-1

**Title:** Modelling of the reliability and degradation of next generation nanoelectronic devices

**Abstract:** In this project we will develop multiscale modelling technology supported by comprehensive experimental characterization techniques to study the degradation and reliability of next generation Complimentary-Metal-Oxide-Semiconductor (CMOS) devices. Building upon fundamental analysis of the structure and electronic properties of relevant materials and interfaces at the quantum mechanical level, we will construct mesoscale models to account for defect generation and impact on CMOS transistor and circuit performance and yield. The models will provide detailed understanding of the common reliability issues and degradation routes, and will be verified by cutting edge experimental characterization. Strong links with industry insures that the project will make a step change in the process of next generation device modelling and design. The project will provide technologists, device engineers and designers in the nano CMOS industry with tools, reference databases and examples of how to produce next generation devices that are economical, efficient, and meet performance, reliability and degradation standards.

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**NBR: 261901** **ACRONYM: AGATHA** **EC FUND: 1708420**

**DG:** RTD **Call: FP7-ENERGY-2010-INDIA** **Thema:** ENERGY.2010.2.1-2

**Title:** Advanced Gratting for Thin Films Solar Cell

**Abstract:** The minority carrier diffusion lengths are small in polycrystalline or amorphous materials used in thin film solar cells, requiring thin layers to maximize charge collection. This is contradictory for the requirement to maximize solar energy absorption. The optical design consisting in increasing solar cell's light-trapping capability is of prime importance. In order to provide total internal reflection, both randomly textured surfaces and regularly patterned surfaces have been investigated. No one of these approaches provides optimal light trapping because no one is suitable for the broad solar spectrum. Recent approaches involving new TCO layers show that double textures provide improved scattering. The AGATHA project aims to realize an advanced light trapping design by combining micro-texturing of glass by hot embossing and nano-texturing of the top TCO layer by etching. The parameters of this "modulated surface texture" can be adjusted to maximize the light scattering in all the solar spectrum to provide a significant increase in both short-circuit current and EQE. Suitable for high production throughput, the new texturation process chain developed in AGATHA fits with the intrinsic low cost nature of thin film solar cells To demonstrate the efficiency of this optical trapping design, the modulated texture concept will be implemented in a-Si:H based, µ-c-Si:H based and CIGS based thin films technologies. The objective is to reduce the active material thickness, from 250 nm up to 150 nm for the a-Si:H, from 1.5 µm up to 1 µm for µc-Si:H and from 2.5 µm up to 800 nm for the CIGS, when increasing the short circuit current of 15 % The choice of these technologies aims to maximize the impact by addressing 70% of the thin film market. According to typical solar cells cost structure, a 15 % reduction of the cost/m2 is achievable. Combined with the Jsc improvement, the implementation of modulated surface texture should result in a 20 % decrease of the €/W indicator. AGATHA is an EU coordinated project in the framework of call FP7-ENERGY-2010-INDIA, foreseeing a simultaneous start with the Indian coordinated project. Accordingly, the Indian project should start at the latest within 3 months of the signature of the EU grant agreement.

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**NBR: 261915** **ACRONYM: GENNESYS** **EC FUND: 150000**

**DG:** RTD **Call: FP7-INFRASTRUCTURES-2010-1** **Thema:** INFRA-2010-3.2

**Title:** International Congress on Nanotechnology and Research Infrastructures

**Abstract:** This Project builds on the GENNESYS European-wide study, which extensively analized the needs and opportunities for coordinating future research and development in nanomaterials science and technology. The mission of the International GENNESYS Congress on Nanotechnology and Research Infrastructures is to establish a strategic

partnership between nanomaterials research laboratories, universities, industry and the European research infrastructures. A well coordinated nanomaterials science and technology program needs to be integrated into research infrastructures in the whole of Europe and in close regional, national and international collaboration to the welfare of the society and of the economy. The GENNESYS International Congress is focused on future visions and actions to achieve breakthroughs in nanomaterials science and technologies. At this prestigious conference various R&D&T roadmaps as worked out by worldwide experts as well as major conclusions and recommendations from the GENNESYS study will be presented to an international audience of major stakeholders in science, politics and industry, stimulating the development of European research policies. The congress will take place in Barcelona during the Spanish EU presidency, the Coordinator ICMAB (Institut de Ciència de Materials de Barcelona from CSIC) will work closely with its partners DESY (Deutsche Elektronen-Synchrotron), PRUAB (Parc de Recerca Universitat Autònoma de Barcelona) and INL (International Iberian Nanotechnology Laboratory), ensuring that the outcomes have the authority and support of leading organisations in this field.

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**NBR: 261936** **ACRONYM: LARGECELLS** **EC FUND: 1646528**

**DG:** RTD **Call: FP7-ENERGY-2010-INDIA** **Thema:** ENERGY.2010.2.1-2

**Title:** Large-area Organic and Hybrid Solar Cells

**Abstract:** The task of developing large-area, thin film solar cells based on polymers as well as solid-state organic-inorganic (hybrid) systems will be undertaken. The required novel materials (charge transport polymers, semiconductor surfactants/compatibilizers and inorganic nanoparticles) will be synthesized and the compounds with the most potential will be scaled-up for the purpose of modern fabrication methods such as roll-to roll (R2R) processing. Additionally, the efficient devices will be tested and analyzed in out-door conditions in India and under accelerated ageing conditions in Israel to understand the degradation mechanism. Finally the basic information from stability studies will be used to design novel materials suitable for highly efficient devices of long-term stability. The programme is intensively intertwined with an Indian consortium, especially in the fields of novel materials, out-door testing, transfer and exchange of knowledge and methods.

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**NBR: 262072** **ACRONYM: µECM** **EC FUND: 1205496**

**DG:** REA **Call: FP7-SME-2010-1** **Thema:** SME-1

**Title:** Micro ECM for SMEs

**Abstract:** Current ECM process technology is limited in machining accuracy and process stability. The primary reason for this limitation is that the power supply units, which are at the heart of ECM are traditionally designed for the millisecond pulsed current range. Developing a power supply unit that has the capability of pulsing in the microsecond / nanosecond range, will result in more control of the process and better product, leading to improved uptimes on the shop floor and improved product quality. The SME partners in this project consortium have identified a commercial opportunity for a new generation of ECM that can offer: - Improved process stability and control - Increased accuracy (at a micron level) - Better process uptime and increased efficiency / outputs - Consistently better performing and better quality products - Shorter product development lead time This project will undertake the research and development work necessary to ensure that the SMEs in the consortium can realise this commercial opportunity through the development of a power supply unit (SMPS) that can support the next generation of ECM. The project aims to develop an SMPS that will deliver quicker electrical current pulsing rates in the microsecond / nanosecond range, resulting in an ECM with a machining accuracy better than 1 micron. The project will also develop a demonstrator / prototype that will be used for validating and demonstrating the next generation ECM. Based on research undertaken by CDAMC (in conjunction with SMPS manufacturers and suppliers), it is clear that power units in this performance range are currently not commercially available. The availability of a new generation of SMPS could result in a major step change in ECM capability and help sustain Europe's leading position in ECM technology.

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**NBR: 262078** **ACRONYM: NANOCOAT** **EC FUND: 1144000**

**DG:** REA **Call: FP7-SME-2010-1** **Thema:** SME-1

**Title:** Nano-structured Aluminium Oxide Coatings

**Abstract:** The objective of the proposed research is to develop improved functionality and new coating applications for aluminium anodisation processes in surface engineering. Project will advance recent innovations towards preparation of ordered nanoporous, nanostructured materials using anodisation methods and applying them to develop commercially relevant novel materials and address the market potential for these improved materials. The nanostructuring process is the growth, during the anodising process, of nanoporous films consisting of well-ordered pores of Anodic Al Oxide in hexagonally close-packed distribution with large aspect ratio. The concept of self-assembly is not yet implemented in actual anodising Al processes due to a number of bottle-necks; project aims at developing pilot line equipment and methodologies enabling to overcome them. The objective is to solve actual market needs by achieving the single stage treatment and industrial evaluation of nanostructured aluminium alloys.

The overall research methodology of the Nanocoat project will follow a progression from detailed laboratory studies through scale-up to applications testing on industrial aluminium grades under industrial relevant conditions, to evaluate their structural and functional characteristics, the reproducibility of the process, and to deliver to end-users suitable test structures as predemonstrators. It is expected that on controlling the formation of the anodised nano-size cell structures on aluminium it will be possible to achieve novel performance in terms of adherence, wettability, corrosion and wear, and adsorption/absorption properties. The scope of applications is very large in the field of surface engineering. The specific anodising markets to be addressed during the project are concerned with improved functionality and new coatings for traditional anodisation processes. In addition, new markets will be assessed, which are based on the enhanced performance of these coatings.

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**NBR: 262099** **ACRONYM: HISP** **EC FUND: 1975683**

**DG:** REA **Call: FP7-SPACE-2010-1** **Thema:** SPA.2010.2.1-04

**Title:** High Performance Solid Propellants for In-Space Propulsion

**Abstract:** The objective of this project is to significantly reduce the time, cost and mass required for spacecrafts to reach their destinations. This is directly linked to their propulsion systems. The only way to significantly improve the performance of a propulsion system is to develop propellants with higher specific impulse. The objective of the project will be met by developing a high performance solid rocket propellant with performance similar or higher compared to state of the art liquid bi-propellants and about 10% higher compared to the current state of the art solid propellants. The project thus address advanced chemical propulsion technologies and more specifically advanced high energy density fuels, for in-space propulsion, mentioned in the Work Programme. Development of a high performance solid propellant will be achieved by using the new high energy density oxidizer ammonium dinitramide, ADN, an energetic binder based on glycidyl azide polymer, GAP, and high energy density fuels such as aluminium hydride (AlH3), nano-aluminium and activated aluminium. Recent breakthroughs in the area of high energy density materials at several laboratories in Europe have shown that development of such propellants now seems viable. The propellant developed will be fully characterized with respect to stability, hazard properties, mechanical properties and performance. The performance will be determined at the end of the project by firing a test motor containing approximately 7 kg of propellant. Finally system analysis will be performed to determine the overall mission benefits by selecting two reference missions. Currently the high energy density materials to be used in the project are produced in small scale. The methods to produce them will be improved in order to produce the amount needed for the project. These production improvements will also make the materials more available to the space community and thus help to implement them in future missions.

**NBR: 262163** **ACRONYM: QNANO** **EC FUND: 7000000**

**DG:** RTD **Call: FP7-INFRASTRUCTURES-2010-1** **Thema:** INFRA-2010-1.1.31

**Title:** A pan-European infrastructure for quality in nanomaterials safety testing

**Abstract:** Nanoscale objects interact with living organisms in a fundamentally new manner, ensuring that a fruitful marriage of nanotechnology and biology will long outlast short term imperatives. Therefore, investment in an infrastructure to drive scientific knowledge of the highest quality will have both immediate benefits of supporting the safety assessment of legacy nanomaterials, as well as pointing towards future (safe) applications with the lasting benefits to society. There are immediate priorities, for few doubt that serious damage to confidence in nanotechnology, unless averted, could result in missed opportunities to benefit society for a generation, or more. QNano will materially affect the outcome, at this pivotal moment of nanotechnology implementation. The overall vision of QNano is the creation of a 'neutral' scientific & technical space in which all stakeholder groups can engage, develop, and share scientific best practice in the field. Initially it will harness resources from across Europe and develop efficient, transparent and effective processes. Thereby it will enable provision of services to its Users, and the broader community, all in the context of a best-practice ethos. This will encourage evidence-based dialogue to prosper between all stakeholders. However, QNano will also pro-actively seek to drive, develop and promote the highest quality research and practices via its JRA, NA and TA functions, with a global perspective and mode of implementation. QNano will also look to the future, beyond the current issues, and promote the growth and development of the science of nanoscale interactions with living organisms. By working with new and emerging scientific research communities from medicine, biology, energy, materials and others, it will seek to forge new directions leading to new (safe, responsible, economically viable) technologies for the benefit of European society.

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**NBR: 262209** **ACRONYM: NASLA** **EC FUND: 1126697**

**DG:** REA **Call: FP7-SME-2010-1** **Thema:** SME-1

**Title:** Nanostructured anti-septical coatings

**Abstract:** The aim of this project is to provide four EU SMEs (Alce Calidad, EASReth, Di.Pro. and Aero Sekur) with a new silver/silica based coating material having anti-septical properties superior to those existing on the market: the coating is made of silica glass and of silver nanoclusters which are embedded in the silica glass. Silica provides

excellent thermal and mechanical properties to the coating. The technique used to deposit this coating (RF sputtering) is suitable to almost every kind of substrate (polymers, metals, glasses, etc.). Results will have a clear and immediate exploitation potential to improve or develop new products currently commercialized by the four SMEs : biomedical implants for DiPro, agro/food industry equipments for Alce Calidad and EASReth and personnel protective systems for Aero Sekur. As soon as the anti-septic functionality can be provided to SMEs products, the following new products will be directly put on the market: Di.Pro: new anti-septical artificial anus ALCE and EASReth: new anti-septical coating on surfaces to be used in food handling and processing; Aero Sekur: new anti-septical textiles for Personal Protection Systems (PPS).

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**NBR: 262348** **ACRONYM: ESMI** **EC FUND: 7800000**

**DG:** RTD **Call: FP7-INFRASTRUCTURES-2010-1** **Thema:** INFRA-2010-1.1.30

**Title:** European Soft Matter Infrastructure

**Abstract:** The central objective of this ESMI proposal is to create a top-level interdisciplinary research infrastructure available to a broad European materials research community. This is of crucial importance to the EU in view of the European strategy for nanosciences and nanotechnology and its implementation report that identifies “a lack of leading interdisciplinary infrastructures”. ESMI offers the most important experimental and synthesis techniques and combines world-class infrastructures with cutting edge scientific expertise through a sophisticated networking programme. The anticipated JRA will further improve the existing infrastructure. Computer simulations being of increasing importance for the understanding and prediction of complex materials, ESMI offers access to simulation groups and their advanced tools. The availability of such an infrastructure will provide soft matter scientists with a broad choice of techniques to address their scientific objectives. It will result in a quantum leap in research opportunities and assure that European scientists have a world-class collaborative capability for their frontier research. ESMI will strongly contribute to a fundamental understanding, allowing the development of new, tailored smart materials. ESMI follows the FP6 experience of the NoE SoftComp. A key feature developed within SoftComp is the highly successful Research Platforms offered to its members, anticipating the spirit of the EU Integrated Infrastructure Initiative. ESMI will promote the SoftComp experience to the European materials community, reflecting the EU recommendations that FP6 collaborative projects “may well lead to new European infrastructures”. Together with a platform for disseminating the results and educating a new generation of young soft matter scientists, ESMI represents an important added value to the European Research Area in nanoscience, nanotechnology and materials science

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**NBR: 262387** **ACRONYM: NANOCORE** **EC FUND: 975240**

**DG:** REA **Call: FP7-SME-2010-1** **Thema:** SME-1

**Title:** Development of a low FST and high mechanical performance nanocomposite foam core material for ferries and cruise ship superstructuresâ€•

**Abstract:** The main scope of the NANOCORE Project is the development of a new and cost-effective production technology for sandwich structures foam core materials with non-toxic flame retardants and enhanced mechanical properties. The primary reason for this new material development is the to meet the current European requirements of the REACH -Registration, Evaluation and Authorisation of Chemicals- legislation and achieve low Fire, Smoke and Toxicity (FST) values, according to the SOLAS reglations. The technology developed during the project will be directly and easily transferable to other polymer-based materials, such as bulk thermoplastics, thermosets, composites and other foams, enabling them to meet the REACH requirements. In fact, the use of the technology is not expected to be restricted purely to the shipbuilding industry; we anticipate that all application of plastic materials requiring FST properties can be met by the NANOCORE technology.

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**NBR: 262470** **ACRONYM: PHOTOMEM** **EC FUND: 909935**

**DG:** REA **Call: FP7-SME-2010-1** **Thema:** SME-1

**Title:** Photocatalytic and membrane technology process for olive oil mill waste water treatment

**Abstract:** Presently available methods for the treatment of olive mill waste water are not acceptable from the environmental point of view (evaporation, discharge) or not suitable from the economic aspect (membrane treatments) costing 10-20% of revenues from oil selling. PHOTOMEM proposes a reliable and affordable technology solution to treat the waste water, applying a novel technical solution based on degradation of organic pollutants through photocatalysis. Dispersed ferromagnetic titania nanoparticles with a magnetic core will be used in a photocatalytic reactor and recovered through a magnetic filter. A subsequent membrane filtration step will be used to achieve the COD limit for reuse of the recycled 85% of wastewater as purified water to a grade compatible with irrigation use and/or dischargeable at low cost in the civil municipal sewer system. The combination of the 2 processes will grant strongly improved performances: double membrane lifetime, 50% cost saving for the operation, 3 times more compact plant, much faster operation. The recovery of polyphenols, a family of added value compounds (hydroxytyrosol) present in the wastewater will be performed to make the process more profitable. The tangible outcomes of the PHOTOMEM project

will be: 1. Production process for ferromagnetic photocatalytic titania nanoparticles, 2. Economical wastewater treatment for OMWW, 3. PHOTOMEM pilot plant of 1 m3/day capacity to validate the treatment and evaluate scale-up. The 2 SMEs (ECS, BIOAZUL) specialised in waste water treatment plants design and construction will sell the PHOTOMEM plant in 2 different countries (Italy, Spain). The producer of custom-made ceramic powders and nanostructured materials for industrial use (MT) will produce the ferromagnetic photocatalytic titania nanoparticles. The end-user (FRA) will apply the technology in its production site. The market potential for such a solution would be of the order of several tens of millions of Euro.

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**NBR: 262539** **ACRONYM: COELUX** **EC FUND: 1223176**

**DG:** REA **Call: FP7-SME-2010-1** **Thema:** SME-1

**Title:** CoeLux: the sky light reconstruction in artificial illumination by means of solid transparent nanocomposites.

**Abstract:** The quality of artificial illumination is a major concern in modern society, where living conditions often deprive us of the comfort of natural light. The global replacement of incandescent with fluorescent or white-LED lighting, foreseen owing to energy-saving constrain, will represent impoverishment in terms of colour-rendering capacity, thus raising the problem to the level of health care. In a scenario where all scientific and industrial efforts are spent on developing low-consumption light sources with the same spectrum as that of the sun, “CoeLux” enters with a ground breaking proposal, based on the evidence that the sun cannot provide natural light in the absence of sky. With the aim of producing those colour distributions captured by artists in their masterpieces, “CoeLux” develops nanocomposite materials, incorporates them in lighting installations, and so recreates the same atmospheric light scattering that produces all colour variety in transmitted sunlight, and the blue tinge in the shade under diffused sky light. In so doing, spectacular sky-and-sun illumination in noon or sunset modes, under a clean or stormy-day sky, will be made available for apartments, working areas, malls, sport centres, railway stations, as well as for squares, parks, and stadiums, during night time. The technology is compatible with low-consumption fluorescent lamps or LED’s, being less demanding in terms of source quality. Finally, “CoeLux” will disseminate the results beyond the project by promoting a European exhibition in which such technological apparatus is shown to provide a unique perspective for a deeper understanding of the connection existing between fine art, architecture, literature, photography and our everyday experience of light.

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**NBR: 262557** **ACRONYM: PLA4FOOD** **EC FUND: 1108845**

**DG:** REA **Call: FP7-SME-2010-1** **Thema:** SME-1

**Title:** Active Multilayer Packaging based on Optimized PLA formulations for Minimally Processed Vegetables and Fruits.

**Abstract:** Fresh Cut Products category refers to fresh vegetables, fruit and market garden products without thermal treatment, prepared, washed and packaged without the incorporation of additives or preservatives and, as an essential requirement, demands the maintenance of the cold chain for its perfect conservation and has a shelf life of approximately 7 days. PLA4FOOD proposal deals with the development of innovative active and biodegradable packaging for fresh-cut food products based on renewable resources thermoplastic materials (PLA-polylactic acid) functionalised with the synergic addition of additives from natural sources (antioxidants, antibacterial and antifungal) in order to increase the shelf-life of packed products. Different encapsulation routes will be tested to protect active additives from processing conditions and to have controlled migration rates. Additionally, to minimize PLA current limitations in flexibility, water barrier properties and processability different additives will be studied including bio-based lactic-acid plasticizers, inorganic nanofillers and organic nucleants. Co-extrusion techniques (blow-film and cast-sheet and thermoforming) will be developed to obtain multilayer structures from different PLA formulations, in order to achieve the best cost/benefit ratio and optimal performance of the active packaging by controlling the thickness and cristallinity of each layer. As a result of this combination of material advances and processing technology improvements, a high performance active food packaging beyond of current state of- the- art will be obtained. The new active and biodegradable packages from renewable sources will provide minimal processed fresh-cut products adequate protection against environmental agents, will improve product properties (quality, shelf-life, microbiological safety and nutritional values), and moreover, will degrade in composting conditions according to the standard UNE-EN 13432.

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**NBR: 262632** **ACRONYM: SOLVER** **EC FUND: 658734**

**DG:** REA **Call: FP7-SME-2010-1** **Thema:** SME-1

**Title:** Solvent purification and recycling in the process industry using innovative membrane technology

**Abstract:** Solvents are widely used in process industries such as chemical, petrochemical, pharmaceutical, food, biotechnology and microelectronics. The recovery of spent solvents containing all types of impurities presents a vast market, targeting thousands of small to medium sized companies in Europe that are generating highly as well as marginally polluted solvent streams. Many current solvent purification and manufacturing practices utilise a traditional, energy-intensive distillation-based

technology in the production and/or recovery of liquid chemicals. This method of processing is costly, inefficient and produces a significant volume of hazardous waste. This project, SOLVER, proposes to debottleneck the heating step as well as the thermal chemical reactions involved, and replace them with membrane separation techniques working at room temperatures and able to achieve separations at the molecular level, i.e. pervaporation (PV) and organic solvent nanofiltration (OSN). Such chemical process intensification in solvent recovery and purification is expected to lead to significant improvements in product cost, materials usage, energy and waste reduction, as well as a decrease in risk and hazards. Thanks to the interdisciplinary and complementary skills of the consortium members, SOLVER aims at demonstrating the potential of OSN/PV technology in solvent manufacturing through lab-scale and pilot testing, but also at more fundamentally understanding the processes and the behavior of the membranes during filtration. The latter will be pursued by advanced characterization and on-line process monitoring tools. SOLVER joins two types of innovative SME end-users building out new business lines to stay ahead of competition. Two SMEs are active in solvent recycling/manufacturing, the other two in OSN/PV membrane production. The SME partners form a strategic supply chain and are expected to continue to leverage on the technological head-start after the project, take the results of the RTD work directly to the market, find new applications for their products, and be the market leaders in their respective sectors.

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**NBR: 262647** **ACRONYM: THERMALCOND** **EC FUND: 1056160**

**DG:** REA **Call: FP7-SME-2010-1** **Thema:** SME-1

**Title:** Polymeric composite materials with enhanced thermal conductivity properties for heat exchangers applications

**Abstract:** The main goal of the project is to develop a new family of low cost polyolefin based components (sheets, pipes and fittings) to be used in the manufacture of flat-plate solar thermal collectors. These components are expected to be a viable alternative to current collector's metallic components. However, due the current limitations of thermoplastics materials (low thermal conductivity and low resistant coatings) two main developments will be claimed in this project: • Polyolefin nanocomposites by using different nanoparticles with high thermal conductive properties as additives. • A novel and specific surface treatment based on SAM technology to provide an energy absorber flexible coating (based on metallic oxides, e.g. TiO2 or ZnO) to the different components. These developments will allow novel low cost and low weight components design's with enhanced thermal conductivity and high solar energy absorption to develop high efficiency thermal collector designs. The use of plastics components instead of metallic ones offers additional advantages: folding and easy assembling structures design, low energy consumption in motorized thermal collectors (follow sun light), corrosion resistance, low friction coefficient (less pump energy consumption), prevent theft or

vandalism (due the low cost of components in comparison with copper). The solar thermal collector parts to be substituted by the new thermal conductive materials and flexible absorber coatings will be the extruded pipes and injected fittings of the collector heat absorption circuit and extruded sheets which will be used as absorber plate. In this context, the polymeric materials appear as a real alternative to develop new low cost procedures in which a wide variety of component's designs could be obtained to optimize the thermal energy obtained per thermal collector surface. Due to their properties, plastics permit to produce any type of part with a free design at very competitive cost.

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**NBR: 262746** **ACRONYM: SIDER** **EC FUND: 1067329**

**DG:** REA **Call: FP7-SPACE-2010-1** **Thema:** SPA.2010.2.3-1

**Title:** RADIATION SHIELDING OF COMPOSITE SPACE ENCLOSURES

**Abstract:** Space electronics systems employ enclosures to shield sensitive components from space radiation. The purpose of shielding is to attenuate the energy of charged particles as they pass through the shield material, such that the energy per unit mass (or dose) absorbed in silicon is sufficiently below the maximum dose ratings of electronic components. The standard practice in space hardware is the use of aluminium as both a radiation shield and structural enclosure. Depending on mission altitude and inclination, and the dose rating of electronics, the thickness of aluminium necessary for shielding can substantially exceed that required for structural strength, resulting in significant weight penalties. Satellite designers use composite materials which have higher strength-to-weight ratios than aluminium. However, conventional graphite epoxy composites are not as efficient shielding materials as aluminium because of their lower density, that is, for the same mass, composites provide 30 to 40% less radiation attenuation than aluminium. Conversely, for the same radiation attenuation, the composites tend to be 30 to 40% thicker than aluminium. The main objective of this project is the development of the technologies and tools required to obtain lightweight, safe, robust and reliable composite structures. The proposal aims to review and develop radiation shielding of composite enclosures to high energy radiation in space. The radiation strategies, modelling and test for space equipment demonstrators will be performed. Countermeasures as tungsten layers, sprayed metallic coating and nano-conductive materials will be evaluated at simple samples to assess its shielding capabilities for the composites boxes. The activity will also adapt to enhance analytical tools and the capabilities, procedures and quality for the radiation facilities directed to composite testing, specially related to deep missions.

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**NBR: 262782** **ACRONYM: APPLE** **EC FUND: 3600000**

**DG:** RTD **Call: FP7-NMP-2010-SME-4** **Thema:** NMP-2010-4.0-4

**Title:** Autonomous Printed Paper products for functional Labels and Electronics

**Abstract:** A new generation of sustainable paper products with specific autonomous functionalities aiming at interacting with their users and/or reporting changes in their environment is developed. The project focuses on the development of new functional materials (paper, fibres, inks), new functional components (battery, sensors, display, memory) and innovative, flexible and cost-effective manufacturing processes based on printing and embedding techniques for the integration of all these functional components on the smart paper substrate. The new APPLE products make extended use of the specific properties of both fibre based products and (nano)fibres individually: the paper is not only used as substrate providing the required mechanical, surface and barrier properties for the printing and integration of the functional components but also the fibres including the incorporation of nanofibres are used as active elements, namely the display and the memory. The new cost-effective manufacturing process based on printing and embedding techniques with a new quality-controlled, flexible concept developed, will open new opportunities for the paper and printing industries (132 000 printers in Europe, among which 85% are SMEs) in the growing market of low-cost and high value added printed electronics. The aim is to demonstrate the new products for target applications: 1) Environment & safety labels, 2) Environment & advertising posters and 3) Smart packaging labels. The project also aims at paving the way for further development of flexible low-cost manufacturing processes of other new high value added products through the integration of latest sensor, energy sources and ICT technology in order to meet societal needs.

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**NBR: 262840** **ACRONYM: DEMCAMER** **EC FUND: 7900000**

**DG:** RTD **Call: FP7-NMP-2010-LARGE-4** **Thema:** NMP.2010.2.4-1

**Title:** Design and Manufacturing of Catalytic Membrane Reactors by developing new nano-architectured catalytic and selective membrane materials

**Abstract:** The DEMCAMER project proposes an answer to the paradigm met by the European Chemical Industry: increase the production rate while keeping the same products quality and reducing both production costs and environmental impacts. Through the implementation of a novel process intensification approach consisting on the combination of reaction and separation in a “Catalytic Membrane Reactor” single unit. The aim of DEMCAMER project is to develop innovative multifunctional Catalytic Membrane Reactors (CMR) based on new nano-architectured catalysts and selective membranes materials to improve their performance, cost effectiveness (i.e.; reducing the number of steps) and sustainability (lower environmental impact and use of new

raw materials) over four selected chemical processes ((Autothermal Reforming (ATR), Fischer-Tropsch (FTS), Water Gas Shift (WGS), and Oxidative Coupling of Methane (OCM)) for pure hydrogen, liquid hydrocarbons and ethylene production. The DEMCAMER scheduled workplan will comprise activities related to the whole product chain: i.e. development of materials/components (membranes, supports, seals, catalyst,..) through integration/validation at lab-scale, until development/validation of four pilot scale CMRs prototypes. Additionally, three research lines dealing with: 1) the collection of specifications and requirements, 2) modelling and simulation of the developed materials and processes, and 3) assessment of environmental, health & safety issues -in relation to the new intensified chemical processes- will be carried out.. For a maximum impact on the European industry this research, covering the complete value chain of catalytic membrane reactors, can only be carried out with a multidisciplinary and complementary team having the right expertise, including top level European Research Institutes and Universities (8 RES) working together with representative top industries (4 SME, 5 IND) in different sectors (from raw materials to chemical end-users).

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**NBR: 262943** **ACRONYM: MULTIFUN** **EC FUND: 9799994**

**DG:** RTD **Call: FP7-NMP-2010-LARGE-4** **Thema:** NMP-2010-4.0-1

**Title:** Multifunctional Nanotechnology for selective detection and Treatment of cancer

**Abstract:** The aim of the MultiFun consortium is to develop and validate a novel and minimally-invasive nanotechnology system to improve cancer diagnosis and treatment. MultiFun nanotechnology is based on multifunctionalised magnetic nanoparticles to selectively target and eliminate breast and pancreatic cancer (stem) cells. The improved magnetic features of the MultiFun magnetic nanoparticles will lead to potential medical applications such as contrast agents and magnetic heating inductors. Moreover, magnetic nanoparticles can be functionalised with ligands to increase their affinity towards cancer cells in order to facilitate diagnosis of tumours by MRI. Targeting peptides and antibodies will be employed, including antibodies against cancer stem cells leading to early cancer detection by MRI means. The same nanoparticles will be used simultaneously as functional nanocarriers and heating inductors in order to provide a combined therapeutic modality. The synergistic effects of drugs, peptides, small RNAs and heat will be evaluated to determine the effectiveness of different therapeutic combinations. Interestingly, the use of ligands will favour the specific application of the therapeutic modalities to cancer (stem) cells, increasing the effectiveness and reducing side effects. Thus, MultiFun multimodal therapeutic approach is designed to efficiently remove cancer cells, including cancer stem cells, from the tumour site. The toxicity of functionalised magnetic nanoparticles will be assessed in vitro and in vivo to warrant a safe use and shed some light on the risks. The distribution and activity evaluation of functionalised nanoparticles will be performed in human breast and pancreatic cancer

xenograft models. The use of novel magnetic nanoparticles for biomedical applications provides opportunities for new instrumentation: 1) detection and quantification of magnetic nanoparticles in blood, urine and tissues, and 2) magnetic heating induction for raising cell temperature.

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**NBR: 262954** **ACRONYM: FIBCEM** **EC FUND: 2747570**

**DG:** RTD **Call: FP7-NMP-2010-SMALL-4** **Thema:** NMP-2010-1.2-2

**Title:** Nanotechnology Enhanced Extruded Fibre Reinforced Foam Cement Based Environmentally Friendly Sandwich Material for Building Applications

**Abstract:** Fibre Reinforced Cement (FRC) is a durable, fire and corrosion resistant material widely used in the construction industry. Coupled with the low cost of Portland cement, these properties make it ideally suited for applications such as roofing tiles and sidings. However the production of cement is associated with a large CO2 'footprint', for each tonne of cement produced nearly one tonne of CO2 is emitted. This has resulted in FRC becoming stigmatised as a 'dirty' material. In addition the high density of cement and hence FRC products results in high transport costs for the producers and high end user installation costs. In order to improve the poor environmental impact of FRC and improve its specific properties, we will develop a cement based, nanotechnology enhanced material produced by a low energy consuming process. The material will consist of a cement based sandwich consisting of a foam cement core and fibre reinforced cement 'skins'. The foam core will be produced using a nanoscale foaming agent to ensure the formation of an optimum closed cell foam structure with a micro-scale cell size with a narrow cell size distribution. Both the foam and the 'skins' will be reinforced with nanoclays to improve both the mechanical and transport properties of the material. The foam cement core will result in a lower density compared to existing FRC, whilst the reinforced skins will ensure the mechanical properties are improved. Added functionality in the form of decreased thermal conductivity and increased sound insulation properties will result from the foam core. The material will be produced by a low energy multilayer extrusion process in which both the foam cement core and fibre reinforced skins are simultaneously formed such that no discontinuity is formed between them. By using a foam core and replacing part of the cement with materials such as fly ash and silica fume, the CO2 footprint of the material will be significantly reduced compared to existing FRC.

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**NBR: 263017** **ACRONYM: NANOCELLUCOMP** **EC FUND: 2411183**

**DG:** RTD **Call: FP7-NMP-2010-SMALL-4** **Thema:** NMP-2010-1.2-2

**Title:** The development of very high performance bioderived composite materials of cellulose nanofibres and polysaccharides.

**Abstract:** The overall aim of the NanoCelluComp project is to develop a technology to utilise the high mechanical performance of cellulose nanofibres, obtained from food processing waste streams, combined with bioderived matrix materials, for the manufacture of high performance composite materials that will replace glass and carbon fibre reinforced plastics in many applications including transportation, wind turbines, biomedical, sport and consumer goods. The technology will include two key stages: 1) liberation of cellulose nanofibres from vegetable food waste and combining the nanofibres with polysaccharides in a single process free of organic solvents to form a 100% bio-composite comprising up to 75 wt% of cellulose nanofibres and 2) orientation of cellulose nanofibres and compaunding the composite in a form easily usable for established technologies, e.g. in the form of bio-prepregs or as composite fibres suitable for bonding with a bioresin. The development of the technology components will be based on the principals of green chemistry and green engineering and aimed to achieve the Technology Readiness Level 6 (a prototype demonstration in a relevant environment) by the end of the project. The project directly addresses all key objectives of the NMP.2010.1.2.1-2 topic. In particular, the new process and materials will significantly contribute to • increase in the sustainability of high performance composites by using vegetable food processing waste; • reduction on the demand of scarce or non-environmentally friendly raw materials by replacing synthetic materials with bioderived nanocellulose and polysaccharides; • elimination of use of volatile solvents in polymer composite production processes by using only water as solvent; • reduction in the energy consumption in composite manufacture. The substitution potential of the new materials shall be investigated in a systematic way during the project.

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**NBR: 263035** **ACRONYM: MICROTHRUST** **EC FUND: 1992906**

**DG:** REA **Call: FP7-SPACE-2010-1** **Thema:** SPA.2010.2.1-04

**Title:** MEMS-Based Electric Micropropulsion for Small Spacecraft to Enable Robotic Space Exploration and Space Science

**Abstract:** Our MicroThrust proposal addresses the FP7 target for advanced in-space propulsion technologies for solar system exploration. This research provides a key component in facilitating exploration missions: a technology that can substantially reduce the cost of undertaking particular types of robotic exploration. Building on the framework of a successful ESA study, our team of leading academics, research institutions and space companies has developed a conceptual design of a very small, yet highly performant electrical propulsion system. The conceptual design is based upon experimental data already obtained by team members. As a result we are confident that this system can

provide the transportation element for taking nano/micro satellites to any location in the Earth-Moon system and will even allow missions to nearby planets and asteroids. The propulsion system will thus permit new exploration mission concepts. These missions due to their size will be developed within a fraction of the time for conventional missions. Their simplicity, perhaps even single instrument spacecraft, will reduce risk for carrying out the mission. Overall this will dramatically reduce cost of individual missions, thus providing more flight opportunities for planetary scientists and planetary exploration. To achieve these goals the propulsion technology has high performance at low mass and low power demand. The propulsion system is a microfabricated colloid thruster having a high degree of subsystem integration. Our work so far has demonstrated the capability of this concept to have a radically reduced part set making substantial progress towards a thruster-on-a-chip. Our experienced team will take the technology through to the significant position of having tested and fully characterized a breadboard model. The design approach is that this is also a proto-flight model such that gaining the final step of a flight test for the hardware is low risk and low development cost.

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**NBR: 263042** **ACRONYM: POINTS** **EC FUND: 3247950**

**DG:** RTD **Call: FP7-NMP-2010-SMALL-4** **Thema:** NMP.2010.2.2-1

**Title:** Printable Organic-Inorganic Transparent Semiconductor Devices

**Abstract:** Europe is targeting a global leadership in the field of printed electronics (PE). This industry is expected to grow to a market size of 47 billion USD by 2018 (Figure 1) with a long-time potential of 300 billion USD by 2030 as estimated by IDTechEx [1,2,48]. The growth rates of the PE industry are expected to be comparable to those of silicon industry in past (inset of Figure 1). This is an ambitious goal for Europe with strong global competition, for example, from Kovio Inc. [54] (US), Nanosolar [53] (US) and Paru Co [50] (Korea). The POINTS project combines the multidisciplinary and complementary competences of top-level European research groups and industries in order to make a significant step towards the above strategic target. For this purpose, the project objectives are set to make break-through advances in the state of the art in terms of new low-temperature printable materials with enhanced performance. This is achieved through combining the best properties of organic and inorganic materials into hybrid structures at both the molecular and at structural-interface level. The POINTS approach is guided by the recent research discoveries of the project partners. Furthermore, expertise of the consortium in cost-efficient mass fabrication processes is coupled to the materials development to obtain optimum performance and processability. Industrial relevancy of the work is assured by selected test structures of industrial interest for ICT applications.

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**NBR: 263073** **ACRONYM: HYMEC** **EC FUND: 3132475**

**DG:** RTD **Call: FP7-NMP-2010-SMALL-4** **Thema:** NMP.2010.2.2-1

**Title:** Hybrid organic/inorganic memory elements for integration of electronic and photonic circuitry

**Abstract:** The objectives of the project "Hybrid organic/inorganic memory elements for integration of electronic and photonic circuitry" (HYMEC) are to resolve fundamental issues of materials science and to realize new hybrid inorganic/organic devices with functionality far beyond current state-of-the-art. This is of direct relevance to the objectives of the FP7-NMP Work Programme, as it calls for "design novel knowledge-based smart materials with tailored properties, releasing their potential for enhanced and innovative applications". Specifically, we will perform research towards understanding and controlling all relevant properties of systems comprising inorganic metal nanoparticles embedded in matrices of conjugated organic materials (organic semiconductors), and we will demonstrate the function of such material hybrids as non-volatile memory elements that can be addressed electrically and optically, which thus represent potential interconnects of future hybrid electronic and photonic circuitry. Moreover, we target implementing cost-efficient production routes, such as printing, as well as exploring the ultimate miniaturization of such memory elements by novel sublimation- and imprinting-based nanostructuring processes. Electronic, optical, dielectric, structural, and morphological properties of our systems will be determined using state-of-the-art experimental techniques and modelling to establish a reliable specific knowledge base, which we will exploit for device fabrication and integration. Through our cooperative efforts, we expect to make use of new knowledge for the realization of reliable non-volatile memory elements (NV-ME) employing resistance switching, with a substantial extension of existing NV-ME functionality, i.e., optical addressing of devices in addition to purely electric.

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**NBR: 263078** **ACRONYM: ROPAS** **EC FUND: 3299419**

**DG:** RTD **Call: FP7-NMP-2010-SME-4** **Thema:** NMP-2010-4.0-4

**Title:** Roll-to-roll PAper Sensors

**Abstract:** ROPAS aims to develop a wireless sensor device on a paper surface which can be manufactured using high-end and low-cost printing techniques. A technological platform is created on a fiber based substrate consisting of the following building blocks: 1. a planar printed battery, 2. a (wireless) signaling device, and 3. a printed sensor switch. Hereto, recent advantages in nanotechnology ((encapsulation) printing, surface modification of fiber based products, sensor and battery development), biotechnology

(enzyme encapsulation) and ICT (wireless communication) are integrated on paper. The technological platform can be used to create various high impact (security) applications, which are demonstrated in security tags and smart labels for anti counterfeiting purposes to integrate displays in paper and smart track and trace envelopes. ROPAS will demonstrate products which give the consumer the benefit of saving time and giving more information about the package than possible today, at a low additional cost. Simultaneously creating new products and virgin businesses to boost the paper and pulp industry. The project results in: design guidelines for the technological platform, the creation of printable sensor materials, and processes for printing of such materials including conditioning of the paper substrates. The consortium is carefully constructed based on: 1. Technologically advanced SMEs: Enfucell (printed battery), and MPicoSys(system architecture), who both received awards for there innovative strength and S2 Grupo (ICT security); 2. SMEs and companies with high potential to market and exploit ROPAS technology: Starcke (security tags), Velpa (smart labels) and ELEP (smart envelopes), Loginle (security shipping) and Oce (printed intelligence); 3. High impact RTDs: TNO (sensor development, coating, printing, ICT), VTT (paper modification, intelligent printing processes, enzyme technology), CEA (battery development) and Itene (environmental studies)

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**NBR: 263091** **ACRONYM: HYSENS** **EC FUND: 3000000**

**DG:** RTD **Call: FP7-NMP-2010-SMALL-4** **Thema:** NMP.2010.2.2-1

**Title:** Hybrid Molecule-Nanocrystal Assemblies for Photonic and Electronic Sensing Applications

**Abstract:** Functional organic molecules and metal and semiconductor nanocrystals represent attractive building blocks due to their composition-, size- and structure-dependent electronic properties, and the ability to design and manipulate these properties via low-cost and established chemical synthesis. Building from the pressing need of the European market to develop novel, scalable and cheaper technologies for sensing applications, the main objective of the HYSENS project is to exploit inexpensive organic functional molecules and inorganic nanocrystals as building blocks to synthesize novel high-knowledge materials for the development of sensors for Group I, II transition metal cations and anions (Cl-, NO3-). The hybrid material intelligence resulting from the engineered combination of individual units will allow the execution of logic functions able to reduce false sensing outputs towards the development of sensors with enhanced selectivity and sensitivity. Our goal is to elucidate the mechanisms governing the optical and electrical response of such engineered hybrid materials arising from the interaction between the organic functional molecule component and the inorganic nanocrystal core component. Establishment of component-function relationships will lead to disruptive new knowledge that will impact on optical and electrical sensors technologies.

**NBR: 263147** **ACRONYM: NANOVALID** **EC FUND: 9598816**

**DG:** RTD **Call: FP7-NMP-2010-LARGE-4** **Thema:** NMP-2010-1.3-1

**Title:** Development of reference methods for hazard identification, risk assessment and LCA of engineered nanomaterials

**Abstract:** The growing development, production and use of engineered nanomaterials and associated products will increase exposure of both humans and ecosystems to these new materials. However, current knowledge is still incomplete and established test methods are as yet inappropriate to reliably assess the extent of exposure and risk of materials at the nano-scale. There is an urgent need to develop methods to overcome the current limitations of existing hazard and risk assessment schemes and to generate the body of reference data needed as the basis for regulative requirements and for measures to safeguard production, application and the disposal of nanomaterials. The proposed project will mobilize the critical mass of international scientific knowledge and technical expertise required to address these questions. Current analytical and toxicity test methods and models will be put to test and subjected to rigorous intercalibration and validation. Where necessary, methods and test materials will be modified, adapted and validated, and new reliable reference methods developed, in cooperation with international standardisation bodies and the concerned industry, to support both pre and co-normative activities and to make the applicability of existing RA and LCA schemes to ENPs more reliable. The feasibility of validated measurement, characterization and test methods will be assessed by selected case studies to help the significant improvement of the performance of existing exposure monitoring systems as well as the development of new risk management and reduction strategies.

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**NBR: 263167** **ACRONYM: NEXTEC** **EC FUND: 3931929**

**DG:** RTD **Call: FP7-NMP-2010-SMALL-4** **Thema:** NMP-2010-1.2-3

**Title:** Next Generation Nano-engineered Thermoelectric Converters - from concept to industrial validation"

**Abstract:** Global energy uncertainty and the limited recourses coupled with increased energy needs fuels the search for improving the efficiency of energy conversion technologies. Although the EU policies target increased use of renewable energy to 12% of gross energy production by 2010, this commitment has also highlighted the urgent need for improving the energy utilization of fossil-fuel based power-plants to allow continuation of the energy intensive lifestyle of EU countries. Thermoelectric (TE) devices can play a

very important role in efficient energy harvesting, and recovery. TE devices are 'fuel-free' solid-state devices with no moving parts and therefore are extremely reliable. TEs can harvest residual low-grade energy which otherwise is wasted. To date, their use is limited by low conversion efficiency. The key factor for improving the performance of TE applications is mainly through the development of TE materials as well as corresponding TE module/device technology and design, based on the material types, which can ensure better performance. Recent advances in nanotechnology offer unprecedented opportunities in designing and fabricating increasingly complex material architectures with controlled and hierarchical microstructures. Theoretical predictions showed that low-dimensional TE materials with figure of merits (a measure of the goodness of TE materials) can be spectacularly enhanced from currently ~1 to extremely high values of 5 -10 (up to 20). The present proposal is concerned with applying modern nanotechnology principles to the design and creation of novel material architectures with enhanced TE properties, with close feedback with theoretical studies. The material architectures considered in this proposal are chosen based on suitability for the development of next generation TE modules and devices, designed for a few specific promising applications including harvesting waste energy from automobiles and environmentally benign, efficient cooling systems

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**NBR: 263207** **ACRONYM: THERMOMAG** **EC FUND: 3986980**

**DG:** RTD **Call: FP7-NMP-2010-SMALL-4** **Thema:** NMP-2010-1.2-3

**Title:** Nanostructured energy-harvesting thermoelectrics based on Mg2Si

**Abstract:** The core concept of the ThermoMag project revolves around developing and delivering new energy-harvesting thermoelectric materials and proof-of-concept modules, based on nanostructured bulk Mg2Si solid solutions. This class of TE material would have the following attractive characteristics: (i) ZT value >1.5 for both n-type and p-type doped material, (ii) operational in the temperature range 300-550ºC, (iii) very low density of 2 g/cm3, especially suitable for transportation applications, (iv) high melting point of >1000ºC, and good thermal stability up to 600ºC, (v) good oxidation and corrosion resistance and mechanical strength, (vi) isotropic thermoelectric properties, (vii) non-toxicity of elements, (viii) widely-available pure materials with very large EU supply chains and (ix) low raw material cost

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**NBR: 263215** **ACRONYM: MARINA** **EC FUND: 8999924**

**DG:** RTD **Call: FP7-NMP-2010-LARGE-4** **Thema:** NMP-2010-1.3-1

**Title:** Managing Risks of Nanoparticles

**Abstract:** While there are standard procedures for product life cycle analysis, exposure, hazard, and risk assessment for traditional chemicals, is not yet clear how these procedures need to be modified to address all the novel properties of nanomaterials. There is a need to develop specific reference methods for all the main steps in managing the potential risk of ENM. The aim of MARINA is to develop such methods. MARINA will address the four central themes in the risk management paradigm for ENM: Materials, Exposure, Hazard and Risk. The methods developed by MARINA will be (i) based on beyond-state-of-the-art understanding of the properties, interaction and fate of ENM in relation to human health and the quality of the environment and will either (ii) be newly developed or adapted from existing ones but ultimately, they will be compared/validated and harmonised/standardised as reference methods for managing the risk of ENM. MARINA will develop a strategy for Risk Management including monitoring systems and measures for minimising massive exposure via explosion or environmental spillage.

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**NBR: 263262** **ACRONYM: STEELCOAT** **EC FUND: 2636625**

**DG:** RTD **Call: FP7-NMP-2010-SMALL-4** **Thema:** NMP-2010-1.2-2

**Title:** Development of green anticorrosion coatings for steel protection based on environmentally friendly nanoparticles and conducting polymers

**Abstract:** The overall objective of the STEELCOAT project is to reduce the use of toxic and hazardous compounds in, and extend the service life of, anticorrosion coatings for steel. The project aims to develop novel green, environmentally friendly, anticorrosion coatings with extended durability for steel protection. We will develop both high solids (HS) solvent-borne and water-borne anticorrosion maintenance coatings. The corrosion protection in these novel coatings will be achieved by combining green nanoparticles, conductive polymers and binders. Steel is an excellent material with high strength and outstanding mechanical properties and it has been used for centuries. Exposing bare steel surfaces to a corrosive environment will lead to corrosion of the steel surfaces and thus pose a potential danger to the whole steel structure, reducing its service life. The cost of corrosion is 3-4 % of GDP worldwide and is therefore a very important issue for all modern societies. Many compounds that are used in the corrosion protection of steel today are hazardous to the environment and to human health. For example, hexavalent chromium has been used in inhibitive pigments but these pigments are being phased out due to environmental and health concerns. Thus, there is an urgent need to replace current paint systems with new effective systems that are more environmental friendly and not hazardous to human health. In the STEELCOAT project we will develop new HS solvent-borne and water-borne anticorrosion maintenance coating systems for steel protection through the combination of nanoceria, nanoclay, conductive polymers and

binders. In order to optimize the corrosion protection of the novel systems we will devote a part of the project to increased fundamental understanding of the mechanisms of corrosion protection. Furthermore, in the development of the coating formulations we will investigate and optimize the mechanical properties of the coating and the adhesion to the steel surface.

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**NBR: 263289** **ACRONYM: GREEN NANO-MESH** **EC FUND: 2692666**

**DG:** RTD **Call: FP7-NMP-2010-SMALL-4** **Thema:** NMP-2010-1.2-2

**Title:** Targeting Hernia Operation Using Sustainable Resources and Green Nanotechnologies. An Integrated Pan-European Approach

**Abstract:** Hernia operations are among the most common surgical procedures performed today with over 20 million cases annually worldwide. Hernia incidents are associated with pain and poor quality-of-life for the patient and lead to enormous healthcare costs, exceeding US $48 billion in the US annually. At present, hernia operations rely heavily on non-degradable polypropylene, polytetrafluoroethylene and nylon meshes. However, these polymers are often associated with foreign body reaction; implant failure; and hernia reoccurrence (over 42%). Moreover, leaking chemicals of these polymers are often deleterious to the surrounding cells and tissue and immobilise post-operative drug treatments. In addition, the process technologies are often associated with environmental risks. Herein, we propose a novel approach that employs recent advances in green nanotechnology and sustainable raw materials for scaffold fabrication that not only will eliminate toxic chemicals from the processes, but will also enhance functional repair due to superior biological properties. Specifically, we aim to fabricate a nano-fibrous mesh with well-defined nano-topography using cellulose; human recombinant collagen, derived from transgenic tobacco plants; and biodegradable polylactic/polyglycolic acid as raw materials. The green credentials of this innovative approach lie in the use of sustainable eco-friendly raw materials that will produce biodegradable waste products and therefore replacing hazardous chemicals currently in use. Thus, this proposal directly fits the call for the substitution of materials or components with 'green nano-technology'.

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**NBR: 263306** **ACRONYM: NANOHITEC** **EC FUND: 3750000**

**DG:** RTD **Call: FP7-NMP-2010-SMALL-4** **Thema:** NMP-2010-1.2-3

**Title:** Nano-structured High-efficiency Thermo-Electric Converters

**Abstract:** The NanoHiTEC project is focused on planar thermo-electric converters based on super-lattice quantum wells, which have shown on laboratory scale already a figure of merit ZT >4 for a wide temperature range. The optimization of BiTe based layer systems as well as Si/SiGe and B4C/B9C lattices will be combined with the development of low cost/high throughput industrial deposition processes for multilayers. Direct p-n-junctions at the hot side of the converter promise further increase in performance and long term stability of the devices, but also simplified fabrication. As technologies for improved material performance multilayered nanowires and sintered nanopowders will be investigated. A central point of NanoHiTEC is the optimization of the passive components (thermal and electrical contacts, substrates) and of new geometries for the layout of planar converters to maximize the system efficiency. In this field particular emphasis is given to the heat flow into the hot and out of the cold side of the active elements where actual devices show the most efficiency loss. The developments in the project are backed by partners experienced in the qualification of thermo-electric materials and devices. Besides the parameters defining the thermoelectric performance - measured in a wide range of temperatures, pressures and magnetic fields - the microstructure, dopant distribution and the inner potentials will be investigated by scanning microscopy and TEM (holography). A major part of the project is the simulation of electronic and phononic properties based on the material microstructure. Intense interaction of theoretical work and characterization results of fabricated systems will pave the way for further enhanced material efficiency and better producibility. A main target is the integration in automotive applications where the high efficiency of superlattice systems over a broad temperature range promises good adaptation to the varying conditions in vehicles.

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**NBR: 263307** **ACRONYM: SAVEME** **EC FUND: 10500000**

**DG:** RTD **Call: FP7-NMP-2010-LARGE-4** **Thema:** NMP-2010-4.0-1

**Title:** A Modular Nanosystems Platform for Advanced Cancer Management: Nano-vehicles

**Abstract:** SaveMe project will address current urgent needs for pancreatic cancer diagnosis and treatment by exploiting partners' expertise and most recent research achievements for the design and development of novel modular nanosystems platform integrating new functionalized nano-core particles and active agents. The modular platform will enable the design of diverse active nanosystems per diagnostic or therapeutic application as defined by their active agent compositions. For diagnostics, superior tracers will be developed for molecular MR/PET and gamma camera imaging, enabling efficient diagnosis and guided surgery respectively. Novel functionalized nano-core systems will be conjugated with semi-confluent active shell layer. Three types of shell layers will be design: (1) novel iron oxide nanoparticles as advanced MRI contrast agents and/or (2) DOTA complexes for MRI (with Gd3+), or PET (with Ga-68), or gamma camera (with Ga-69); (3) Integrating within one tracer both iron oxide nanoparticles and DOTA-Ga-68

complexes for a sequential or simultaneous MR/PET imaging. For therapeutics, active nanosystems will be developed to deliver (1) therapeutic siRNAs or (2) anti-MP-inhibitory-scFVs. These non-classic anti-tumor drugs will be designed based on an extensive tumor degradome analysis for combining blockage of selective matrix MPs, thus preventing basic invasive and metastasis steps, with siRNA based neutralization of secondary molecular effects induced by the specific protease inhibition. Individualized degradome analysis will be developed for potential profiling of anti-MP and siRNAs based therapy per patient. To facilitate the above diagnostics and therapeutic effects, advanced tumor targeting and penetration active agents will be linked to nano-core functionalized groups, including a biocompatible PEG layer linked to tumor selective MMP substrate molecules and highly safe and potent novel somatostatin analogue peptides targeting SSTR overexpression.

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**NBR: 263335** **ACRONYM: MULTIHY** **EC FUND: 3390722**

**DG:** RTD **Call: FP7-NMP-2010-SMALL-4** **Thema:** NMP.2010.2.5-1

**Title:** Multiscale Modelling of Hydrogen Embrittlement

**Abstract:** The proposed project aims to advance the state-of-the-art of numerical modelling of hydrogen embrittlement (HE). The primary focus and novelty of the project is the description of H transport in modern advanced materials with complex microstructures. This goal will be achieved through development of a multiscale modelling framework, which will enable the extraction and propagation of information pertaining to critical microstructural features from the nanometer level to the macro scale. The key aspect of this modelling effort is the incorporation of atomistically-derived diffusion barriers for critical H trapping sites into continuum and component level models. The gap between the atomistic and continuum hierarchies will be bridged by kinetic Monte Carlo calculations that will provide a basis for derivation of a novel set of equations for H diffusion. These equations will be applied in continuum and component models for boundary conditions representative of those that occur in service. The boundary conditions will be furnished by data collected in-service and from experimental measurements. The outcome of the modelling will be further related to degradation and reliability assessment by the determination of semi-empirical fracture criteria, which will be incorporated into the model at the component level. The modelling will be validated at all levels using advanced experimental techniques. The effectiveness of the proposed simulation framework will be demonstrated by investigating the role of microstructure in three contrasting industrial problems, which have been specified by companies involved in the development and application of advanced materials. The project represents a significant step towards a universal, engineer-oriented software tool for the evaluation of the HE susceptibility of materials and components based on real microstructural information and environmental conditions.

**NBR: 263363** **ACRONYM: INNOVABONE** **EC FUND: 6199649**

**DG:** RTD **Call: FP7-NMP-2010-LARGE-4** **Thema:** NMP.2010.2.3-1

**Title:** Novel biomimetic strategy for bone regeneration

**Abstract:** The importance of developing novel approaches for bone repair is underscored by the heavy burden on health care costs and patient suffering caused by traumatic, osteoporotic and osteolytic metastatic bone lesions. To address these health challenges, we will develop optimally performing bioinspired biomaterials mimicking the natural physiological processes underlying bone repair. Our overall approach is to produce smart bioactive 3D scaffolds to fit within bone lesions, which we will then inject with functional, genetically-engineered self-solidifying elastin-like polymers with absolute-controlled molecular architecture and sequences containing specific domains for cell attachment, growth factors and calcium phosphate nanoparticles. The resulting bioactive, biodegradable scaffolds, biogels and regenerated bone will be analysed for biomaterial effects on bone growth, healing, foreign body reactions using cutting-edge in vitro assays, BioMEMS technology, in vivo animal models, non-invasive imaging and gene expression profiling for discovery of biomarkers associated with bone repair. Biomaterials will also be tested with biodynamic assays to assess strength, durability, toxicology, sterilisation reaction, eco-toxicology and risk assessment. Our multidisciplinary consortium with its extensive, state-of-the-art expertise consisting of private and public partners, cellular and molecular biologists, immunologists, physicists, bioengineers, and orthopaedic surgeons will tackle serious bone lesions with a comprehensive work plan to develop a prototype, evaluate it in vivo and in vitro, upscale its production and prepare the final material for clinical phase trials and commercialisation of the dual component product. Our ultimate aims are to ensure strong, healthy bone regeneration, reduce pain and suffering and to become a competitor in the biomaterials market of Europe.

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**NBR: 263374** **ACRONYM: IN-SIGHT** **EC FUND: 3180000**

**DG:** RTD **Call: FP7-NMP-2010-SME-4** **Thema:** NMP-2010-1.2-1

**Title:** In-line characterisation of nanoparticles using a combination of analytical techniques in real time

**Abstract:** In-Sight is a SME-driven project on the in-line characterisation of nanoparticles during nanomaterial manufacturing. This in-line characterisation is the ultimate goal. Within the time-span of the project (3 years) it is our objective to show that a combination of

analytical techniques that are capable of real time measurements will provide valuable information for the nanoparticle user. It is our objective to enable monitoring real-time (unexpected) changes in particle count and dimensions during particle processing. The outcome of the project will contribute to minimised batch failure, improved yield, troubleshooting scale-up. In addition, the in-line measurements will enable 'quality by design' throughout development of new products. Finally the result of the project will be reflected in a reduction of development time, as well as easy scale-up from the lab to manufacturing.

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**NBR: 263382** **ACRONYM: PHOTOSENS** **EC FUND: 4900000**

**DG:** RTD **Call: FP7-NMP-2010-LARGE-4** **Thema:** NMP-2010-4.0-2

**Title:** Large Area Photonic Crystal Chemical Sensors

**Abstract:** The PHOTOSENS project aims to develop a low-cost, mass-manufacturable, nano-structured, large-area multi-parameter sensor array using Photonic Crystal (PC) and enhanced Surface Enhanced Raman Scattering (SERS) methodologies for environmental and pharmaceutical applications. Integrating the PC and SERS based sensors with integrated optics coupling structures within a single sensor platform allows the implementation of a high-performance multi-parameter sensor. Currently, utilization of multi-parameter sensing is hindered by the lack of low-cost and, highly reproducibility fabrication methods for nano-structured surfaces. PHOTOSENS addresses these challenges by developing new roll-to-roll nanoimprinting manufacturing methods. Scientific work includes development of the multilayer nanophotonic sensor structure, nanoimprint materials for large-area fabrication, functionalized molecularly imprinted polymers (MIP) and high-volume manufacturing methods including Roll-to-Roll (R2R) nanoimprint processes for nano-texturing of large-area plastic films. PHOTOSENS will greatly increase understanding of photonic and plasmonic dispersion and field localisation effects in periodic nanostructures, such as Photonic Crystals, and their applicability to sensing purposes. PHOTOSENS demonstrates a multi-parameter large-area sensor platform for environmental and pharmaceutical sensing. The consortium is composed of 4 world-class research organisations, 2 SMEs and 3 large companies from 6 European countries representing the complete supply chain from technology developers to end users. The position of these organizations in their respective markets guarantees that the results of the project will be widely exploited providing the companies with a technological advantage over their global competitors and thus creating new high-tech jobs in Europe in this rapidly growing market.

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**NBR: 263406** **ACRONYM: NANOONSPECT** **EC FUND: 3399554**

**DG:** RTD **Call: FP7-NMP-2010-SME-4** **Thema:** NMP-2010-1.2-1

**Title:** Reliable Integrated On-Line Characterisation Tool for Thermoplastic Compound

**Abstract:** The SME-driven NanoOnSpect project aims to accelerate the commercialisation of innovative polymer nanocomposites (PNCs), combining developments in online sensor technology, artificial intelligence-based signal analysis and real-time process optimisation to create a comprehensive solution to quality problems. NanoOnSpect has 3 development aims: 1) Newly-developed online characterisation techniques will be combined in a "one-box" characterisation unit. This will be able to determine dispersion, particle size, particle network formation and resulting composite properties online under demanding industrial conditions, with a (factor 2 to 10) higher resolution than conventional online characterisation tools. 2) An Artificial Neural Network and Expert System (ES) module will be developed to analyse sensor signals, predict the complex quality of the PNC and calculate new input parameters for the compounding line. 3) A breakthrough concept will be developed to adapt the mixing process during composite production, based on feedback from the ES. The characterisation tool and process control technique will allow precise adjustment of the composite properties (e.g. dispersion-dependent properties) during production. This will improve product quality, allow the reliable production of PNCs with tailored functions and reduce waste production. The technology will be validated in existing production lines for two particle types. NanoOnSpect will also deliver in depth understanding of materials and processing, shortening material development cycles and formulation changeovers. The NanoOnSpect consortium, consisting of 8 SMEs, 2 RTD performers and 2 associations, combines competences in measurement technology/automation, polymer processing technology, end use and demonstration, standardisation, dissemination and training. The project results will dramatically increase competitiveness and strengthen the market position of the mainly SME-based European PNC compounding industry.

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**NBR: 263416** **ACRONYM: ARTIVASC 3D** **EC FUND: 7800000**

**DG:** RTD **Call: FP7-NMP-2010-LARGE-4** **Thema:** NMP.2010.2.3-1

**Title:** Artificial vascularised scaffolds for 3D-tissue-regeneration

**Abstract:** The use of bioartificial tissue for regenerative medicine offers great therapeutic potential, but also has to meet high demands with respect to the interaction of the bioartificial devices and natural tissues. Key issues for the successful use of bioartifical tissues as natural tissue replacements are their long term functional stability and biocompatible integration. Up to now, various approaches for the generation of bioartificial tissues have not succeeded due to insufficient nutrition and oxygen supply. Therefore, current tissue engineered products have only been realised for non vascularised tissues such as cartilage. ArtiVasc 3D will break new ground and overcome

these challenges by providing a micro- and nano-scale based manufacturing and functionalisation technology for the generation of fully vascularised bioartificial tissue that enables entire nutrition and metabolism. The bioartificial vascularised skin engineered in ArtiVasc 3D will, for the first time, allow tissue replacement with optimum properties. ArtiVasc 3D will research and develop an innovative combination of hi-tech engineering such as micro-scale printing, nano-scale multiphoton polymerisation and electro-spinning with biological research on biochemical surface modification and complex cell culture. In a multidisciplinary approach, experts in biomaterial development, cell-matrix interaction, angiogenesis, tissue engineering, simulation, design and fabrication methods work together to generate bioartificial vascularised skin in a fully automated and standardised manufacturing approach. This bioartificial vascularised skin will be of great value in a vast array of clinical treatments, e.g. as a transplant in trauma treatment. In addition, this new bioartificial vascularised skin will be used as an innovative in vitro skin equivalent for pharmaceutical, cosmetics or chemical substance testing, which represents a promising method to reduce expensive, ethically disputed animal testing.

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**NBR: 263440** **ACRONYM: NEAT** **EC FUND: 2882506**

**DG:** RTD **Call: FP7-NMP-2010-SMALL-4** **Thema:** NMP-2010-1.2-3

**Title:** Nanoparticle Embedded in Alloy Thermoelectrics

**Abstract:** The project aims at developing “Nanoparticle Embedded in Alloy Thermoelectric (NEAT)” materials to harvest energy in the KW range. Thermoelectric Generators will help to recover some of the huge amount of wasted high-grade thermal power leading to significant savings in fuel and Green House Gas emissions. These innovative materials will be designed to perform efficient waste heat recovery in high thermal differentials provided by high temperature industrial processes and automotive engines. Conventional thermoelectric materials are toping ZT values of 1 since several decades. Recently, ZT values as high as 3 at 550K have been reported for thin film nanostructured materials. However, bulk materials are far from reaching a similar performance. NEAT is an innovative nanocomposite alloy capable of attaining ZT>3 at high and medium temperatures. The material concept is based on the joint optimization of nanoinclusions and grain boundaries in order to maximize phonon scattering at multiple length scales, without increasing electron scattering significantly. NEAT will focus on: - Mg2Si nanoparticles in n-Mg2SiSn alloy matrix, for medium temperature range (500-800K) - Ge and Silicide nanoparticles in SiGe alloy matrix, for high temperature range (900-1200K) - A graded nanocomposite of both medium and high temperature materials, for high thermal gradients accommodation. The concept achievement will require manufacturing process innovations enabling the inclusion of well controlled nanoparticles in a host polycrystalline alloy and the preservation of the initial architecture during the sintering. It will benefit from advanced theoretical simulation providing fundamental physical

understanding, and materials development guidance. The demonstration of the nanocomposites thermoelectric performances in proof of concept thermoelectric generators and the assessment of its energy pay-back will unambiguously state the potential industrial impact of the project outcomes.

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**NBR: 263510** **ACRONYM: SNOW CONTROL** **EC FUND: 2820000**

**DG:** RTD **Call: FP7-NMP-2010-SME-4** **Thema:** NMP-2010-1.2-1

**Title:** Integrated Real-Time Measurement Platforms for Nanoparticles and Nanoparticle Thin Films

**Abstract:** One of the major barriers towards the successful introduction of nanoparticles (NP) into many applications is the lack of a tight control on their properties ((size, shape, crystallinity, composition, core-shell, functionalization, etc). This can only be resolved by the simultaneous use of several metrology methods, to extract the relevant information in real-time and to establish of a feedback control loop. In this project we take the first steps towards this goal by proposing the required concepts and methods. The main goal of this project is therefore to develop real-time characterization metrology tools to measure the properties of nanoparticles, functionalized NPs and NP thin films. To enable a real-time and a complete characterization of NP properties we drastically extend the capabilities of Dynamic Light Scattering (DLS), Zeta Potential (ZP) and Small Angle X-ray Scattering (SAXS) and combine those into an integrated real-time NPs measurement platform. New methods to measure the flux of NPs in the gas phase and the properties of NP thin films and heterostructures will be developed based on ultraviolet and vacuum ultraviolet radiation. These will be combined with Grazing Incidence SAXS and Reflection High Energy Electron Diffraction into a real-time NP thin film measurement platform. Standard operating procedures will be developed for these instrument combinations so that a multi-method metrology standard can be defined based on the (quasi-) simultaneous measurement of complimentary properties with the different tools. Finally, the capabilities of these integrated measurement platforms will be tested against two high throughput lines for the production of NP in solution and for the growth of NP thin films. This project will be carried out by four Small and Medium Enterprises -- all active in equipment and metrology development -- two Industrial partners and two institutes for Higher and Secondary Education.

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**NBR: 263878** **ACRONYM: BISNANO** **EC FUND: 1700000**

**DG:** RTD **Call: FP7-NMP-2010-EU-Mexico** **Thema:** NMP.2010.1.2-4

**Title:** Functionalities of Bismuth based nanostructures

**Abstract:** The aim of the present project is to explore the properties and possible applications of bismuth and bismuth based compounds when they are synthesized at the nanometric scale. This approach is motivated by the uncommon but advantageous properties of bismuth which, in part, have been exploited for many years. However, there are many unexplored possibilities and with the advent of nanotechnology new prospectives may be expected. We believe this approach will lead to new and high-tech applications of bismuth based materials, adding new value to one of the major mining products of Mexico (second most important world production) and boost the related economic benefits which at present are low. In the project, we have integrated complementary research groups from Mexico and Europe covering interdisciplinary fields. In the thematic work-packages, research groups working on the synthesis of the nanostructured materials will collaborate with others doing the physical-chemical materials characterization and the application development. The materials include Bi, Bi2O3 and Bi2S3 nanostructures, Bismuth metal oxide nanostructured ceramics and thin films, bismuth-based nanocomposites where Bi constitutes the nanoscale inclusion and the matrices varied from ceramics, polymers or glasses, and finally Bi superconductors. Extensive chemical and structural characterization will be required to correlate the synthesis parameters with the physical properties. Finally, the project includes the physical evaluation focused on the optical, electrical, magnetic, ferroelectric, etc. properties, according to the proposed applications. The time scale of the project is sufficient for the preparation of master's degree students and the initial years of doctorate students. These students will work in a very academic-rich environment and at the same time have contact with the industrial partners in the project, some of which are leaders in the development of Bi-based commercial products.

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**NBR: 263942** **ACRONYM: NANOMINING** **EC FUND: 1800000**

**DG:** RTD **Call: FP7-NMP-2010-EU-Mexico** **Thema:** NMP.2010.1.2-4

**Title:** Development of new nanocomposites using materials from mining industry

**Abstract:** Silver nanoparticles and silver based nanostructured composites are being frequently used in a variety of biomedical and industrial applications, such as an antimicrobial agents, lead-free solders, electric contact materials, gas-sensitive sensor, etc. The most complicated Silver using problems are related to: i) recovery of silver from ore waste materials; ii) the controlled synthesis of metal nanoparticles of well-defined size, shape and composition; iii) nanoparticles incorporation to desired implant surfaces; iv) synthesis of Silver based nanostructured composites for industrial purposes. The main goal of the Project is to develop: 1. Clean and efficient procedure of silver recovery from waste: Combined Mechanical Activation – Thermal Oxidation Processing jarosite type residues to alleviate and accelerate the following precious metal leaching; 2. Combined

nanotechnology of biological synthesis (use of plants for the nanoparticles synthesis) of Ag nanoparticles and its deposition on implant surfaces by electrophoretic and plasma spraying deposition; 3. Nanostructuring technology of Silver based nanocomposites manufacturing for electrical contact applications. Pilot production and trials of developed Ag nanoparticle modified implants and Ag based nanostructured composites: 1. TiO2 and Hydroxyapatite Ca10(PO4)6(OH)2) coated implants which are widely used in orthopaedic surgery because of their good biocompatibility related to the osteoconductive properties of calcium phosphate coating; 2. Ag-SnO contacts for electrical systems; these composites combine high resistance to welding and to electric arch erosion of the refractory phases with the high electric and thermal conductivities.

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**NBR: 263946** **ACRONYM: MINANO** **EC FUND: 1494447**

**DG:** RTD **Call: FP7-NMP-2010-EU-Mexico** **Thema:** NMP.2010.1.2-4

**Title:** New high-quality mined nanomaterials mass produced for plastic and wood-plastic nanocomposites

**Abstract:** Successful adaptation of nanotechnology in the end-products requires an access to the nanofiller technology and to the raw materials. The MINANO-project brings together partners representing end-user's product know-how, formulation and processing technology and most importantly secure and reliable source of nano raw materials. Although there has been tremendous development in the area of nanocompounds with improved functionality, there exists a need to develop an efficient, continuous method of large-scale, low-cost synthesis of such materials. To answer to this need the following steps are suggested: 1) Integrate the functionalization of the high-quality nanoparticles directly on the continuous mass-production process already in the mining industry, 2) ensure controlled dispersion to the matrix material in large scale by cooperation between nanoparticle producer and end-product manufacturer, 3) assure sustainable and safe production and use by state-of-the-art life-cycle analysis. Based on the mass production process and cooperative value chain we concentrate on three major functionalities: Flame retardancy, UV resistance and antimicrobial properties. These properties are achieved by functionalized Mg(OH)2, ZnO and Ag nanoparticles. Societal and industrial impacts of these properties are extensive and there is a strong request of these functionalities for both plastic and wood-plastic based matrix materials. The use of nano-sized functional filler materials enables to use smaller amount of additives thus giving better recyclability, lower weight, higher mechanical strength and potential multifunctional features to the end-product. The combination of new nanofunctionalities gives far reaching possibilities for new types of functional plastics, and completely new possibilities to wood-plastic composites as well. This moves both mining industry and end-product companies towards high-tech on the long run.

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**NBR: 263963** **ACRONYM: CUVITO** **EC FUND: 1000000**

**DG:** RTD **Call: FP7-NMP-2010-EU-Mexico** **Thema:** NMP.2010.1.2-4

**Title:** Nano-structured copper coatings, based on Vitolane technology, for antimicrobial applications

**Abstract:** Antibacterial coatings represent a huge market in healthcare and food sectors.CuVito brings together Mexican mining products and European product development, to produce a state-of-the-art copper nano-structured coating. Bacteria in hospitals present a major health issue.The effectiveness of cleaning is considerably enhanced on smooth, scratch-free surfaces.Anti-bacterial silver coatings are available; however they are not used in hospitals due to cost, effectiveness and durability.Copper offers a low cost, effective and environmentally friendly solution that could be readily adopted. The challenge is to retain copper nano-particles in a structure that provides antibacterial functionality, but prevents leaching.The CuVito consortium believes that the silsesquioxane structure, formed using Vitolane technology is the answer. Silsesquioxanes have the formula RSiO1.5 (where R is an organic ligand), and form cage or ladder structures.They confer hardness and abrasion resistance to coatings and, by selecting appropriate R groups (e.g. acrylate, glycidoxy) can chemically bond to the organic resin in the formulation controlling cross-link density to enhance durability.Hence silsesquioxanes are inherently suited to use in coatings for surfaces which require regular cleaning.Silsesquioxanes have been available for some years but at a prohibitively high cost, due to the complexity of manufacture.Vitolane technology is an alternative, cost effective production route which has been patented and is currently being scaled up commercially.It has a unique processing feature in allowing simple selection of R groups and it is proposed to use this to bond directly to the copper nanoparticles, resolving the issue of leaching.The objectives of the project of the project are: 1.Develop a copper nano-particle production process 2.Functionalise silsesquioxanes with copper using Vitolane technology 3.Produce a commercially acceptable coating 4.Validate coating in a hospital environment

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**NBR: 264034** **ACRONYM: Q-NET** **EC FUND: 4022055**

**DG:** REA **Call: FP7-PEOPLE-2010-ITN** **Thema:** FP7-PEOPLE-2010-ITN

**Title:** Quantum Nano-Electronics Training

**Abstract:** Q-NET will provide initial training in the general field of Quantum Nano-Electronics, in particular spintronics, molecular electronics, single-electronics, quantum dots and nanowires, nano-cooling. The recruited researchers will be trained to state-of-the-art technologies of nanofabrication, near-field microscopies, transport measurement under

extreme conditions (low temperatures, magnetic field, radio-frequency irradiation) and theoretical calculations. Ultimate detectors, innovative local probes, new metrological standards, on chip micro-coolers will be developed. 25 key scientists from 8 different institutions will interact as a consistent training staff monitored by the supervisory board by reference to a 8-task detailed program. The 16 trained young researchers will be at the ESR level for 93%. The training will be implemented through systematic secondments of young researchers from one partner to several academic and private partners. The project website will be set-up to support the training strategy and the tracing of results and IPR. It will be animated by the recruited researchers under the supervision of the coordinator. Q-NET will organize sessions of the European School On Nanosciences and Nanotechnologies (ESONN) devoted to Quantum Nano-Electronics, combining both theoretical and practical training. Annual special training sessions will be organized, covering seven complementary domains such as ethics, project management, IPR, communication skills ... The consortium involves most of the leading groups in the domain which contributed these last ten years to the European leadership in Quantum Nano-Electronics. Q-NET will significantly contribute to meet the needs of the industry in terms of highly-skilled and open-minded scientists for leading the competition in "Beyond C-MOS" Nano-Electronics.

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**NBR: 264098** **ACRONYM: MAMA** **EC FUND: 2400000**

**DG:** RTD **Call: FP7-REGPOT-2010-1** **Thema:** REGPOT

**Title:** Unlocking research potential for multifunctional advanced materials and nanoscale phenomena

**Abstract:** Multifunctional materials are defined as those materials that perform specific functions other than possessing a load bearing capacity. Examples include semiconductors, magnetic materials, piezoelectrics and ionic conductors. In this context, transition metal oxides (TMOs) have been attracting an ever-increasing interest, due to the wide variety of physical properties that they exhibit, including unconventional superconductivity, piezo- and ferro-electricity, colossal magnetoresistance, multiferroicity and a number of exotic magnetic, charge and orbital orderings. Furthermore, oxide interface can show properties at the nanometer scale that are qualitatively different from their single building blocks, allowing to engineer novel functionalities by resorting to the controlled growth of epitaxial heterostructures. Still, the analysis and modelling of hybrid heterostructures, where layers of functional organic materials represents an ultimate and even more ambitious challenge. Such features are believed to open the route to the fabrication of device prototypes where multiple functionalities of TMOs and functional organic layers are nano-integrated on the same chip. The range of application sectors is correspondingly large, including: information and communications technology, energy generation, storage and transport. Within the project the CNR-SPIN Campania aims at unlocking its research potential to face the scientific challenge behind the complexity of

multifunctional advanced materials and nanoscale phenomena. By exploiting the available partnerships expertises and experimental endowment, complemented by the new resources provided within the project, the CNR-SPIN Campania aims at achieving the highest level of competitiveness about issues of i) materials fabrication, by addressing the growth of very high quality samples in the different shapes of epitaxial thin films and single crystals, also integrated together in complex heterostructures and; ii) advanced material characterizations, both based on matter-light interaction, on scanning probe techniques and on electron-magnetic transport, iii) theoretical modelling and advanced multi-scale computation to analyze and get insight into different physical properties of innovative materials.

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**NBR: 264362** **ACRONYM: TOPBIO** **EC FUND: 3232751**

**DG:** REA **Call: FP7-PEOPLE-2010-ITN** **Thema:** FP7-PEOPLE-2010-ITN

**Title:** Two Photon Absorbers for Biomedical Applications

**Abstract:** Two-photon absorption is a photophysical process with diverse applications in medicine (photodynamic therapy), neurophysiology, cell biology (microscopy, photo-activated drugs) and biomedical engineering (fabrication of micro-needle arrays and tissue scaffolds). Many of these applications will only have a major impact when better dyes become available with stronger two-photon absorption, as well as improved secondary properties (photostability, biocompatibility, etc). Advances in optical engineering will also be critical. Two-photon absorption is an important newly emerging supra-discipline at the intersection of Biology, Chemistry, Physics and Engineering. This network will be the first initiative of its kind in this area. TOPBIO will train young researchers in many different aspects of the field, by coupling together research groups with internationally recognized expertise in synthesis, molecular design, theory, photophysics, photobiology, cell biology, engineering, nanotechnology, microscopy and laser physics. We aim not only to train ESR and ER in an interdisciplinary manner but also (by developing new generations of functional dyes and applying them in real biomedical applications) to improve the quality of life in Europe and to strengthen the EU economy. TOPBIO will provide an excellent mechanism for promoting interdisciplinary training, by exchanging PhD students on secondments between collaborating laboratories, through regular progress meetings, workshops and tutorial schools. TOPBIO brings together leading experts from universities and private sector organizations across Europe. It has an exceptional ratio of private to academic partners (1:2). The perfect match of complementary expertise, multidisciplinarity, high involvement of companies and focus on the real needs of society will enable us to deliver high quality training in skills which are perfectly matched to the needs of future employers, thus producing a workforce which will be in high demand.

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**NBR: 264506** **ACRONYM: NANOTOES** **EC FUND: 3254330**

**DG:** REA **Call: FP7-PEOPLE-2010-ITN** **Thema:** FP7-PEOPLE-2010-ITN

**Title:** Nanotechnology: Training Of Experts in Safety

**Abstract:** Life Sciences and Nano Sciences interact today mainly in two areas: in the evaluation of accidental health and environmental effects derived from engineered nanomaterials, and in development and biological/clinical evaluation of nanoparticles with intended biological effects for application in medicine and biotechnology. It is essential for producers, distributors, consumers and regulators that the safety of products containing nanomaterials can be certified with reliable, validated assays. Research efforts are under way to establish suitable test methods and to understand mechanisms potentially leading to a detrimental impact of nanomaterials on human health and on the environment. However, this important field still urgently lacks sufficient trained personnel. The ITN "Nanotechnology: Training Of Experts in Safety" (NanoTOES) will establish a network of research projects working towards the refinement and standardisation of existing methods, will develop novel assays, and will during this process provide interdisciplinary training to Early Stage Researchers (ESR) and Experienced Researchers (ER) working at the intersection of biosciences and nanosciences. A suite of methods developed and validated in the NanoTOES project shall have utility in characterising the biological effects of nanomaterials, including their impact on the environment, and will add significantly to our understanding of the biological actions of nanomaterials and their resultant effects on human health and the environment. Equally, the influence of biological entities (molecules, cells, tissues) on the properties of nanomaterials will be investigated. This aspect is crucial to understanding the properties of nanomaterials in organisms and in the environment, but nevertheless this issue has been so far not sufficiently explored. These timely and novel studies will address the pressing need for such trained personnel, and enable European science in this area to remain globally competitive.

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**NBR: 264645** **ACRONYM: DYNAMOL** **EC FUND: 3232230**

**DG:** REA **Call: FP7-PEOPLE-2010-ITN** **Thema:** FP7-PEOPLE-2010-ITN

**Title:** Dynamic Molecular Nanostructures

**Abstract:** The ITN DYNAMOL will establish a powerful new approach for the preparation of nanostructures based on dynamic covalent chemistry. This approach combines the advantages of covalent synthesis (robustness of bonds) with those of non-covalent synthesis (error correction, responsiveness) without any of the disadvantages. It therefore has the potential to provide unique solutions for several important challenges

in the preparation of nanostructures that still need to be addressed. The ITN unites most European leading academic experts in the area of dynamic covalent chemistry with partners from the industrial sector. Expertise of all partners encompasses the areas of supramolecular chemistry and dynamic covalent chemistry, but individual research competences are quite diverse focussing on molecularly defined nanostructures, analysis of nanostructures, and novel applications. The complementarity and diversity thus realised is crucial for successful research and training in this area. Moreover, the two full partners from the private sector, both representing small and medium-sized enterprises, and the two associated partners, one a major chemical company, will have the critical role to bridge fundamental science with application and commercialisation of the results. The objectives of the network will be achieved by recruiting 11 early stage researchers and 1 experienced researcher. A mobility program will allow the researchers to spend time in the various laboratories of the network, thus facilitating sharing of resources and expertise. Local training at the host institutions will be supplemented by a training programme containing various elements such as biannual workshops and a summer school with the participation of experts from outside the network to realise efficient exchange of information and transfer of knowledge. The ITN thus combines world-class research with a unique education to strengthen Europe's prominence in the timely field of nanoscience.

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**NBR: 264694** **ACRONYM: GENIUS** **EC FUND: 4321902**

**DG:** REA **Call: FP7-PEOPLE-2010-ITN** **Thema:** FP7-PEOPLE-2010-ITN

**Title:** GraphenE-orgaNIc hybrid architectures for organic electronics: a mUltiSite training action

**Abstract:** GENIUS aims at offering highest-quality supra-sectoral and cross-disciplinary training to a pool of promising young researchers, in an area at the interface between Supramolecular Chemistry, Materials- and Nano-Science, Physics and Electrical Engineering. GENIUS appointees will be trained in lecture courses, dedicated schools and workshops, and through an ambitious and carefully planned research activity that benefits both from the expertise of world-leading PIs with remarkable track records in both training and research. GENIUS is designed to generate new scientific and technological knowledge on the production, processing and characterization of graphene based supramolecular architectures, taking advantage of the outstanding physical and electronic properties of graphene. We are particularly interested in developing and studying a new graphene-organic hybrid material (GOH) for applications in microelectronics; the new material proposed, while maintaining the excellent properties of classical graphene, will have improved processability in solution, chemical functionalization and tunable optoelectronic properties. We will use supramolecular interactions to cover single graphene sheets with polycyclic aromatic hydrocarbon molecules, i.e. nano-graphenes (NG), which are composed of i) an aromatic core able to

interact strongly with graphene, and ii) flexible side chains to provide solubility in organic solvents. NGs adsorb reversibly on graphene by pi-pi interactions, forming ordered adlayers on its surface with pre-programmed molecule spacing and orientation, ultimately modulating the electronic properties of the GOH. The interaction of NG and graphene will be studied at macroscopic scale by optical, Raman and current-voltage spectroscopy, and at molecular and microscopic scales primarily by Scanning Probe Microscopies. As a proof of principle, field effect transistors and photovoltaics devices based on graphene-NG composites will be tested.

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**NBR: 264710** **ACRONYM: MANANO** **EC FUND: 2313945**

**DG:** REA **Call: FP7-PEOPLE-2010-ITN** **Thema:** FP7-PEOPLE-2010-ITN

**Title:** MANUFACTURING AND APPLICATIONS OF NANOSTRUCTURED MATERIALS

**Abstract:** Nanotechnologies and nanostructured materials is expected to be the most promising area of technological development and among the most likely to deliver substantial economic and societal benefits to the EU in the 21st century. It is a time of rapid advance in the development of these technologies, which can organize materials at the nanoscale and tailor their properties. This offers exciting possibilities in virtually all sectors of EU activity and could create entirely new industries. However, the exploitation of nanomaterials by European industry has been disappointing and one of the critical reasons for this is a general shortage of scientists/engineers with the knowledge to undertake relevant research and transfer the research findings into industrial production. The aim of the proposal is to encourage the very best researchers to get jobs in EU industry, where they can create these breakthrough opportunities. This will be achieved by giving them intellectually stimulating and industrially relevant research projects that will be undertaken in collaboration with universities and industry, and include industrial secondments together with comprehensive technical and complementary skills training. A network of 5 universities and research institutes, and 10 companies from 8 EU countries will be set up to carry out the integrated research and training programme. The research will include new nanomaterials for organic electronics, lithium ion batteries, solar cells on roof tiles and on flexible polymers, ultra-light aerogels for transportation and an innovative technique for 3D characterization at the nanoscale. The network will train a new generation of ESRs in the disciplines needed to understand nanotechnology and the complementary skills to enhance their career progression. All recruits employed in the programme will be ESRs and the partners will provide experienced researchers from their own staff without charge to the European Commission

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**NBR: 264737** **ACRONYM: BIOMAX** **EC FUND: 3236392**

**DG:** REA **Call: FP7-PEOPLE-2010-ITN** **Thema:** FP7-PEOPLE-2010-ITN

**Title:** Novel diagnostic bio-assays based on magnetic particles

**Abstract:** Nanotechnology-based in-vitro diagnostics is set to solve several important problems in global healthcare. R&D in this field requires collaborations between experts from different scientific disciplines with a strong focus on the integration of bio-, nano- and microtechnologies. However, such personnel is still scarce. This BioMaX training-through-research network responds to the need for skilled personnel able to combine bio-assay knowledge with novel integrated device technologies. The general objective of the BioMaX network is to train the next generation of biomolecular researchers in industry and academia by establishing a pan-European network that aims at improving the career perspectives of young potentials and putting Europe at the R&D frontline in integrated diagnostics. To realize this objective a top-level consortium, consisting of 6 academic and 4 industrial partners, will establish an innovative S&T and training program. The network will investigate novel diagnostic bio-assay technologies for proteins and nucleic acids based on magnetic particles (MPs), with demonstration of breakthroughs in analytical performance and device integration. The program is built on three scientific pillars: molecular bio-assay strategies, biomolecular kinetics, and integrated bio-assay devices. The training and exchange program addresses both academic expertise and complementary skills tailored to the individual needs of the fellows. Fellows will be offered local training at doctoral schools and network-wide training through summer schools, workshops, conferences, and secondments. With the creation of this leadership network on novel biological assays, BioMaX assists the EC in reaching their objectives in the area of mobility and training of researchers and the realization of a powerful European Research Area with joint research priorities and a world class infrastructure capable of attracting a critical mass of human and financial resources.

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**NBR: 264872** **ACRONYM: NAMASEN** **EC FUND: 2906854**

**DG:** REA **Call: FP7-PEOPLE-2010-ITN** **Thema:** FP7-PEOPLE-2010-ITN

**Title:** Neuroelectronics and nanotechnology: towards a Multidisciplinary Approach for the Science and Engineering of Neuronal Networks

**Abstract:** We identify Neuroelectronics as a novel mature discipline, at the boundaries between neurobiology, electrophysiology, computational neurosciences, microelectronics, materials sciences, and nanotechnologies. In the proposed Marie-Curie consortium, each of these components, as well as the specific application contexts (i.e. basic research, neuroprosthetics, and pharmaceutical applications), are represented and combined in a concerted effort, towards the training of a new generation of researchers

and professionals. We target both technological priorities, such as the development of novel multi-electrode arrays and advanced interfaces that functionally interact with neurons and networks; and scientific priorities, considering and studying neuro-electronic hybrids as devices able to undergo a functional and anatomical reconfiguration, on the basis of the activity-dependent plasticity and rewiring properties of neurons, under some control of the experimenter. Our ultimate aim is to lay the foundation of a virtual institute for the multi-disciplinary study of neuroengineering and network-neurosciences that will train a new generation of scientists and professionals and that will contribute to Europe's leading role in scientific innovation. We strongly believe in the unique training potential of our consortium: neuroelectronics to analyze and synthesize neuronal networks, using artificial devices able to co-operate with neurons, thereby crossing the barriers between artificial devices and neurons. Knocking down the barriers between natural and artificial is, in the words of Edoardo Boncinelli (founding figure in developmental biology and 2005 EMBO Awardee for Communication in the Life Sciences), "a fantastic crossing between biological evolution and cultural evolution, a shortcut between culture and nature".

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**NBR: 265073** **ACRONYM: NANOWIRING** **EC FUND: 4716261**

**DG:** REA **Call: FP7-PEOPLE-2010-ITN** **Thema:** FP7-PEOPLE-2010-ITN

**Title:** Semiconductor nanowires: from fundamental physics to device applications

**Abstract:** The interest in bottom-up fabricated semiconductor nanowires (NWs) has been growing steadily in the last years due to their potential as basic building blocks of nanoscale devices and circuits. Investigations performed so far try to exploit three unique properties of NWs: First, they are the smallest dimension structures that allow optical guiding and electrical contacting simultaneously. Second, their large surface to volume ratio enhances their interaction with the environment, turning them into optimal chemical and biological sensors. Finally, their anisotropic geometry makes their optical and electrical properties dramatically dependent on their orientation, allowing their use as polarization-dependent sensors. Most NW applications rely on the ability to grow, characterize (structurally, optically and electronically) and manipulate both individual and collections of NWs. To date it is rather difficult to find a single research group covering all of the above competences, and students (or post-docs) usually focus on a single aspect of NW-based device realization (either growth, characterization, simulation or device assembly). The scope of this project is to create a European Network of experienced teams that will provide early stage researchers with a multidisciplinary framework and a comprehensive training in the field of NW physics and applications. The active involvement of industrial partners will ensure that the acquired competences are driven by industrial needs, such as scalable and low cost NW production. The interaction with associated industrial partners will also add to the employability of the recruited researchers through the exposure to the private sector. The main applications

that we intend to address within the project time are the following: (i) nanowires for sensing applications, (ii) nanowires for optoelectronics (iii) nanowires for nanoelectronics and (iv) nanowires for energy harvesting.

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**NBR: 265435** **ACRONYM: AMI-4EUROPE** **EC FUND: 2649386**

**DG:** RTD **Call: FP7-REGIONS-2010-1** **Thema:** REGIONS

**Title:** Advanced, Cross-Disciplinary & Integrated Medical Imaging for all Europeans through a Network of Regional Clusters and Development Strategies"

**Abstract:** Thanks to the developments in Medical Imaging Diagnosis is earlier than ever. Physicians have more information and insight. Care is less invasive and less painful for patients. Access to tests and treatments is easier as imaging procedures are available in convenient settings, such as independent imaging centers. In addition, patient outcomes— from fewer complications to saved lives—are dramatically improved. And we are not at the end of our journey, yet!. The “Next Generation” of Medical Imaging is just here out of the integration and cross-disciplinary use of NanoMedicine, Pharmacological breakthroughs, Biotechnologies for healthcare and ICT combined with standard Medical Imaging evolution. Unfortunately, the healthcare sector is quite diverse and collaboration has been difficult as a result, so the challenge is to build expertise in the development of integrated systems that address unmet clinical needs while providing a solid and consistent network of R&D + Innovation groups. Co-ordination and integration of Research-Driven Clusters under the so called “Triple Helix III approach is a must in order to achieve the growth and competitiveness opportunities that Advanced Medical Imaging brings to the European society. AMI-4EUROPE is to co-ordinate, integrate and set up a newly defined EU-based Value Chain on Advanced, Cross-disciplinary and Integrated Medical Imaging by taking full advantage of all strengths that European stakeholders have while targeting the market niches that are arising as the Next Generation Medical Imaging unfolds itself out of the convergence of Nanomedicine, Pharmaceutical and Biotechnologies for healthcare and taking advantage of the ICT developments. Socio-economic impact at European level will be significant. Sustainability and synergy-searching are assured: Many regional governments are backing up AMI-4EUROPE.

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**NBR: 265593** **ACRONYM: ELECTRICAL** **EC FUND: 2878153**

**DG:** RTD **Call: FP7-AAT-2010-RTD-1** **Thema:** AAT.2010.1.1-2.

**Title:** NOVEL AERONAUTICAL MULTIFUNCTIONAL COMPOSITE STRUCTURES WITH BULK ELECTRICAL CONDUCTIVITY AND SELF-SENSING CAPABILITIES

**Abstract:** Aircraft structures appear to be strategic components to be manufactured in composite materials for reducing weight, although new questions regarding electrical conductivity have arisen such as static discharge, electrical bonding and grounding, interference shielding and current return through the structure. These functions can be met by the use of technologies based on nanocomposites, which indeed combine mechanical properties, electrical and thermal conductivity. Based on the needs to provide advanced concepts and technologies for increased and optimised use of light-weight composite smart materials, the main objective of ELECTRICAL is the development of novel multifunctional composite structures with bulk electrical conductivity and self-sensing capabilities. The project will investigate and develop alternative emerging methods to manufacture nanoreinforced carbon based composites compatible with current industrial manufacturing processes of composites. The main goals will be: *Development of innovative technologies to convert nanofillers into engineered multifunctional preforms, prepregs, buckypapers, etc.., for further use in CFRP structures. CNTs bulk doped resins are also to be considered as the main base-line. *Manufacture, characterisation and test CFRP based materials with such multifunctional engineered nanostructures. Liquid moulding technologies will be considered, althoug autoclave technology will also be considered as the second alternative. The three main functionalities will be: *Electrical conductivity of aeronautical composite structures to meet requirements regarding static discharge, electrical bonding and grounding, etc. *Monitoring and optimisation of CFRP curing process by Dielectric Mapping. *Quality assurance of final component (delaminations, etc) by Electrical Resistance Tomography (ERT).

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**NBR: 265721** **ACRONYM: RADAR** **EC FUND: 2926127**

**DG:** RTD **Call: FP7-KBBE-2010-4** **Thema:** KBBE.2010.3.2-04

**Title:** Rationally Designed Aquatic Receptors integrated in label-free biosensor platforms for remote surveillance of toxins and pollutants

**Abstract:** RADAR is a 7-member consortium that aims to develop a robust, sensitive, and versatile label-free, biosensor platform for spot measurements and on-line monitoring of toxins and pollutants in food production processes and in the aquatic environment. Specificity towards chemical pollutants and toxins is achieved by using recombinant receptors (namely the estrogen receptor and the aryl hydrocarbon receptor) whose amino acid sequences have been rationally designed based on genomic and functional information from aquatic organisms. Sensitivity of the biosensor is increased by the unique combination of isotachophoretic pre-concentration step, and surface nanostructuring & chemical modification. The integration of the label-free detection sensors with an on-

line automated sample handling and a wireless communication system will yield a best-in-class biosensor platform for robust, specific and sensitive detection of EDCs and PAHs in difficult operating conditions. To validate the RADAR biosensor the consortium will test the biosensors in fresh and marine water, in fish farms, and in food products such as fish, fruit juices, and milk. Through their contacts in these industries, the partners will evaluate the performance of the biosensors in such environments, analyzing a representative number of samples and reporting on the stability, ruggedness and accuracy of the sensors used under laboratory and real test conditions. This project is expected to have a high economic impact, since our cost-effective sensor could find a worldwide distribution in most food production and water testing lines as supported by Agilent Technologies Inc.

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**NBR: 265799** **ACRONYM: SIINN** **EC FUND: 1499493**

**DG:** RTD **Call: FP7-ERANET-2010-RTD** **Thema:** NMP-FP7-2010-4.0-7

**Title:** Safe Implementation of Innovative Nanoscience and Nanotechnology

**Abstract:** The primary aim of the SIINN ERA-NET is to promote the rapid transfer of the results of nanoscience and nanotechnology (N&N) research into industrial application by helping to create reliable conditions. In order to strengthen the European Research Area and to coordinate N&N-related R&D work, the project has the aim of bringing together a broad network of ministries, funding agencies, academic and industrial institutions to create a sustainable transnational programme of joint R&D in N&N. The commercial application of nanomaterials (NMs) products is increasing rapidly, but one important question, the safety of NMs, still represents a barrier to their wide innovative use. Therefore the first priority of SIINN is to focus on developing a consolidated framework to address nano-related risks and the management of these risks for humans and the environment by investigating the toxicological behaviour of NMs. European R&D activities in N&N remain largely uncoordinated and fragmented, resulting in the sub-optimal use of available resources, such as human resources, research equipment and funding. Since available data on their toxicological behaviour is often scant, unreliable or contradictory, the SIINN Project will focus on ways of remedying this situation. After defining the criteria important for NM toxicology, the environmental health and safety (EHS) information currently available to Europe will be examined. Liaisons will strategically be established and maintained. They will network with organisations looking into the EHS of NMs within Europe and abroad with the aim of continually exchanging information with these. Available information will be examined for their reliability in respect of the assessment of the risks of NMs towards human health and to the environment and major knowledge gaps identified. At least two joint, transnational calls will be organised during the initial lifetime of SIINN in order to fill these gaps.

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**NBR: 265803** **ACRONYM: ROCK'N...** **EC FUND: 50000**

**DG:** REA **Call: FP7-PEOPLE-2010-NIGHT** **Thema:** FP7-PEOPLE-2009-NIGHT

**Title:** RESEARCHERS ON THE ROCK

**Abstract:** ROCK'N…aims to favour a direct contact between researchers and the large public in way that people could understand and give the right value to the great contribution they give to our daily life. At the same time, the project intends to offer researchers opportunities to meet the public at large in informal situations, not only sharing with it experiences, emotions, difficulties, but also involving it in significant aspects of their life not only regarding their professional ones. The scheduled events had been selected to offer public surprising and unexpected approaches to attract the interest of different target groups: researchers and public will appreciate themselves walking, playing music, dances, cooking, playing games... The project will develop in fascinating locations where researches on the mystery of our origin will be compared with the results of the most modern and "future" scientific field: primates and the iCub robot, archaeology and virtual reality, botanic and nanotechnologies, everything experienced by amusing and shared fun. ROCK'N…will reinforce the main Genoese scientific institutions not only at local but also at regional, national and European level and, at the same time, it will give support to young researchers to make easier their relations with entrepreneurs and companies favouring their career development. Moreover, the project will impact also in the Mediterranean countries by the "2010 Biennale del Mediterraneo" involving, in this way, researchers from the third countries as well. The project is included in the extraordinary process aiming at developing the hi-tech pole in Genoa and at promoting the citizens interest in researchers activity, by mean of the Festival of Science that, since 8 years, is having an extraordinary success. The combination between science and Archaeological Museum offers a further interesting element for the public at large, promoting a wider idea of culture able to overcome the traditional academic boundaries.

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**NBR: 265933** **ACRONYM: HOTZYME** **EC FUND: 5518544**

**DG:** RTD **Call: FP7-KBBE-2010-4** **Thema:** KBBE.2010.3.5-04

**Title:** Systematic screening for novel hydrolases from hot environments

**Abstract:** There is a strong need for new thermostable hydrolases with appropriate performance and/or novel functionalities that could provide huge savings in time, money and energy for industrial processes. The HotZyme project aims to identify such enzymes from hot terrestial environments, using metagenomic screening methods. New bioinfomatic tools will be developed to facilitate function prediction of genes from metagenomes that

show low or no sequence homology to enzymes of known function. A range of high-throughput screening technologies will be employed to identify novel hydrolases. The consortium is composed of 13 partners from 10 European countries plus one partner from USA. The strong expertise in Microbiology, Moleculary Biology, Biochemistry, Biophysics, Geochemistry, Nanotechnology and Bioinformatics from our partners will be integrated in the project to ensure the fulfilment of the proposed tasks. Importantly, the five industrial partners, including three SMEs, will seek to commercialize the project results, thus ensuring a European wide impact, post project.

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**NBR: 265971** **ACRONYM: LABOHR** **EC FUND: 2930728**

**DG:** RTD **Call: FP7-2010-GC-ELECTROCHEMICAL-STORAGE** **Thema:** GC.NMP.2010-1

**Title:** Lithium-Air Batteries with split Oxygen Harvesting and Redox processes

**Abstract:** LABOHR aims to develop Ultra High-Energy battery systems for automotive applications making use of lithium or novel alloy anodes, innovative O2 cathode operating in the liquid phase and a novel system for harvesting O2 from air, which can be regenerated during their operative life without need of disassembling. LABOHR has 5 key objectives: (i) development of a green and safe electrolyte chemistry based on non-volatile, non-flammable ionic liquids (ILs); (ii) use of novel nanostructured high capacity anodes in combination with ionic liquid-based electrolytes; (iii) use of novel 3-D nanostructured O2 cathodes making use of IL-based O2 carriers/electrolytes with the goal to understand and improve the electrode and electrolyte properties and thus their interactions; (iv) development of an innovative device capable of harvesting dry O2 from air; and (v) construction of fully integrated rechargeable lithium-Air cells with optimized electrodes, electrolytes, O2-harvesting system and other ancillaries. Accordingly, LABOHR aims to overcome the energy limitation for the application of the present Li-ion technology in electric vehicles with the goal to: 1- perform frontier research and breakthrough work to position Europe as a leader in the developing field of high energy, environmentally benign and safe batteries and to maintain the leadership in the field of ILs; 2- develop appropriate electrolytes and nanostructured electrodes which combination allows to realize ultra-high energy batteries; 3- develop a battery system concept as well as prototypes of the key components (cell and O2-harvesting device) to verify the feasibility of automotive systems with: A) specific energy and power higher than 500 Wh/kg and 200 W/kg; B) coulombic efficiency higher than 99% during cycling; C) cycle life of 1,000 cycles with 40% maximum loss of capacity, cycling between 90% and 10% SOC; and D) evaluate their integration in electric cars and renewable energy systems.

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**NBR: 266029** **ACRONYM: AEROMUCO** **EC FUND: 3772261**

**DG:** RTD **Call: FP7-AAT-2010-RTD-1** **Thema:** AAT.2010.1.1-2.

**Title:** AERODynamic Surfaces by advanced MUltifunctional COatings

**Abstract:** The main objective of the AEROMUCO project is to develop and evaluate a number of alternative – and highly innovative – active and passive multi-functional surface protection systems for future generation of aircraft, leading to a significant improvement in fuel efficiency and a reduction in CO2 and NOx emissions. Two technological routes to achieve this goal will be explored: • The reduction of the energy consumption for inflight de-icing through the development of coatings that exploit the use of a new generation of low-energy consuming active de-icing systems. • The development of durable and effective active and passive surface protection systems that will facilitate and maintain laminar boundary layers on aerodynamic surfaces. These coatings will reduce insect adhesion through novel, low-surface-energy concepts and remove insect residue through photoactive/enzymatic activity on nanotextured coatings. The high-speed airflow over aircraft can contain sand, water droplets, insects, ice crystals and other particles, and there thus exists a significant challenge to produce protective coatings for this varied and demanding environment. AEROMUCO will develop multifunctional coatings with both anti-contamination and anti-icing properties that will also protect the aircraft's skin from erosion. These novel coatings will be customized to the requirements of the location on the wing (e.g. leading edge contamination avoidance, upper surface runback ice prevention). The multi-disciplinary approach will yield technological improvements beyond the state of the art through a structured, but innovative, research strategy. A comprehensive set of unique tests will be performed, including ice build-up tests (microscopic and full-scale icing wind tunnel tests), comparative rain erosion tests, abrasion tests, and an assessment of kinetic of enzyme processes.

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**NBR: 266033** **ACRONYM: SPECIAL** **EC FUND: 2991682**

**DG:** RTD **Call: FP7-KBBE-2010-4** **Thema:** KBBE.2010.3.2-01

**Title:** Sponge Enzymes and Cells for Innovative AppLications

**Abstract:** The SPECIAL project aims at delivering breakthrough technologies for the biotechnological production of cellular metabolites and extracellular biomaterials from marine sponges. These include a platform technology to produce secondary metabolites from a wide range of sponge species, a novel in vitro method for the production of biosilica and recombinant technology for the production of marine collagen. Research on cellular metabolites will be based upon our recent finding that non-growing sponges continuously release large amounts of cellular material. Production of biosilica will be realized through biosintering, a novel enzymatic process that was recently discovered in siliceous sponges. Research on sponge collagen will focus on finding the optimal

conditions for expression of the related genes. Alongside this research, the project will identify and develop new products from sponges, thus fully realizing the promises of marine biotechnology. Specifically, the project will focus on potential anticancer drugs and novel biomedical/industrial applications of biosilica and collagen, hereby taking advantage of the unique physico-chemical properties of these extracellular sponge products. The consortium unites seven world-class research institutions covering a wide range of marine biotechnology-related disciplines and four knowledge-intensive SMEs that are active in the field of sponge culture, drug development and nanobiotechnology. The project is clearly reflecting the strategic objectives outlined in the position paper European Marine Strategy (2008); it will enhance marine biotechnology at a multi-disciplinary, European level and provide new opportunities for the European industry to exploit natural marine resources in a sustainable way. In particular the biotechnological potential of marine sponges, which has for a long time been considered as an eternal promise, will be realized through the SPECIAL project.

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**NBR: 266084** **ACRONYM: HI-WI** **EC FUND: 2408673**

**DG:** RTD **Call: FP7-SST-2010-RTD-1** **Thema:** GC-SST.2010.7-1.

**Title:** Materials and drives for High & Wide efficiency electric powertrains

**Abstract:** Presently, drives for Fully Electric Vehicles and Hybrid Electric Vehicles develop their highest efficiency of around 93~95% within a speed range of usually 1/4 to 1/3 of the maximum, and at an ideal torque, whereas in real-life driving cycles the motor operates at a wider range of speeds and at partial load, resulting in much lower efficiency. Hi-Wi will address this mismatch by advancing the design and manufacture of drive trains through: - Holistic design across magnetic, thermal, mechanical and control electronics/algorithms in line with real-life use rather than a single-point “rating”. - The use of variable flux approaches in which the flux of the motor can be adjusted in real-time according to the load condition to maximise efficiency. In addition to the above efficiency gains, Hi-Wi will couple its novel design approach to breakthroughs in materials and manufacturing, winning size, weight, logistical and cost savings through: - Adopting nano-scale materials advances to create superior field strengths with reduced reliance upon rare earths and their economically-vulnerable strategic supply chains. - Adopting nano-scale manufacturing advances to create permanent magnets having ideal geometries, reduced size and weight, and improved mechanical and thermal behaviour. The 3-year Hi-Wi project will deliver: - Innovative approaches to the holistic design and modelling of rotating magnetic machines tailored specifically to the in-use conditions of FEV and HEV drive cycles. - Breakthrough materials and manufacturing advances based upon a fusion of nano-scale science and high-technology high-speed production techniques. - The prototyping and demonstration of innovative drive topologies showing high efficiencies over the wide torque/speed range demanded by real-use driving cycles.

- Guidelines and IPR to support a world-leading EU position in the economic mass manufacture of motors to exploit the global uptake of FEV and HEV mobili

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**NBR: 266090** **ACRONYM: SOMABAT** **EC FUND: 3700896**

**DG:** RTD **Call: FP7-2010-GC-ELECTROCHEMICAL-STORAGE** **Thema:** GC.NMP.2010-1

**Title:** Development of novel SOlid MAterials for high power Li polymer BATteries (SOMABAT). Recyclability of components.

**Abstract:** SOMABAT aims to develop more environmental friendly, safer and better performing high power Li polymer battery by the development of novel breakthrough recyclable solid materials to be used as anode, cathode and solid polymer electrolyte, new alternatives to recycle the different components of the battery and cycle life analysis. This challenge will be achieved by using new low-cost synthesis and processing methods in which it is possible to tailor the different properties of the materials. Development of different novel synthetic and recyclable materials based carbon based hybrid materials, novel LiFePO4 and LiFeMnPO4 based nanocomposite cathode with a conductive polymers or carbons, and highly conductive electrolyte membranes with porous architecture based on fluorinated matrices with nanosized particles and others based on a series of polyphosphates and polyphosphonates polymers will respond to the very ambitious challenge of adequate energy density, lifetime and safety. An assessment and test of the potential recyclability and revalorisation of the battery components developed and life cycle assessment of the cell will allow the development of a more environmental friendly Li polymer battery in which a 50 % weight of the battery will be recyclable and a reduction of the final cost of the battery up to 150 €/KWh. The consortium has made up with experts in the field and complementary in terms of R&D expertise and geographic distribution.

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**NBR: 266097** **ACRONYM: AUTOSUPERCAP** **EC FUND: 3974595**

**DG:** RTD **Call: FP7-2010-GC-ELECTROCHEMICAL-STORAGE** **Thema:** GC.NMP.2010-1

**Title:** DEVELOPMENT OF HIGH ENERGY/HIGH POWER DENSITY SUPERCAPACITORS FOR AUTOMOTIVE APPLICATIONS

**Abstract:** Supercapacitors are essential in electric vehicles for supplying power during acceleration and recovering braking energy. High power and sufficient energy density (per kilo) are required for both an effective power system but also to reduce weight. There are several issues to achieve a high performance/low weight power system that need to be addressed by various groups of scientists and engineers in an integrated framework. In

this proposal, we have assembled a multidisciplinary Consortium of leading researchers, organisations, highly experienced industrialists, and highly active SMEs to tackle the problems. As a result, we are aiming at developing supercapacitors of both high power and high energy density at affordable levels by the automotive industry, and of higher sustainability than many current electrochemical storage devices. These targets will be achieved by integrating several novel stages: (a) computer simulations to optimise the power system and the design of the supercapacitor bank for different supercapacitor models, representing the different supercapacitor cells to be developed and tested in this project; (b) we shall use carbon-based electrodes to reduce the amount of rare and expensive metals; (c) we shall use electrolytes of high operating voltage to increase both power and energy density, although the problem is that they have large ions that reduce the effective surface area of porous electrodes due to low diffusivity; (d) in this case, innovative electrode structures will be developed based on combinations of high surface area/large pore activated carbon electrodes and low resistance carbon fibrous materials or carbon nanotubes; graphene will also be investigated.(e) novel methodologies will be developed to integrate the innovative electrode materials in the fabrication process for manufacturing large supercapacitors. These will be tested both at small-scale, and in realistic electric car test rig tests, and be cost and life-cycle-assessed.

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**NBR: 266391** **ACRONYM: ELECTROGRAPH** **EC FUND: 3584077**

**DG:** RTD **Call: FP7-2010-GC-ELECTROCHEMICAL-STORAGE** **Thema:** GC.NMP.2010-1

**Title:** Graphene-based Electrodes for Application in Supercapacitors

**Abstract:** For vehicle applications, it is desirable to have devices with high energy density, high power density, long cycle and shelf life, and low cost. Supercapacitors are considered one of the newest innovations in the field of electrical energy storage. In hybrid electric vehicle, supercapacitors can be coupled with fuel cells or batteries to deliver the high power needed during acceleration as well as to recover the available energy during regenerative braking. To design a supercapacitor for a specific application that requires high energy density or high power density or both, proper electrode materials and a suitable electrolyte are to be chosen. The combination of graphene and graphene-based material as electrode materials, and the use of room temperature ionic liquids (RTILs) may exhibit excellent performance in supercapacitors. Graphene based materials can be obtained by a bottom-up approach in a more controllable fashion. The enhanced capacitive behaviour of this material may be obtained by the proper alignment of graphene sheets as well as the interconnected nanoscale channels. However, these studies are still at the primary stage, and further studies are necessary. The ElectroGraph project follows a technology driven approach. It is thus obvious that the development of both electrode materials as well as the electrolyte solutions is required in order to optimize the overall performance of the supercapacitor. The main novelty of the technical development is the optimised production of graphene with its properties

specifically defined and adjusted for application as electrode material in energy storage devices. This would be achieved through defining of processing parameters to tailor-made graphene with a specific surface area, size and corresponding electrical properties is a new consideration. The ElectroGraph will use an integrated approach in development of both electrode materials as well as the electrolyte solutions as required for optimising the overall performance of supercapacitors.

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**NBR: 266515** **ACRONYM: MOLD-ERA** **EC FUND: 498888**

**DG:** RTD **Call: FP7-INCO-2010-6** **Thema:** INCO.2010-6.1

**Title:** Preparation for Moldovaâ€™s integration into the European Research Area and into the Community R&D Framework Programs on the basis of scientific excellence

**Abstract:** The objective of MOLD-ERA is to assist the Institute of Electronic Engineering and Nanotechnologies (IEEN) to develop and implement a research strategy that will expand its activities and increase its level of excellence, so that it can compete and collaborate with leading research institutions in Europe. MOLD-ERA training activities will be opened up and integrate with activities in other relevant research institutions in Moldova to increase the project impact and thereby increase the generation of wealth in the region. Focus is on a new research and training program for young researchers that will result in creation of a leading European infrastructure at IEEN in nanotechnology and nanobiology. This will be implemented through: - Combining existing facilities at IEEN in the field of Nanotechnology with new equipment to be purchased to extend this research area to Nanobiology with a focus on the properties and structure of complex assemblies of biomolecules, such as biochips, molecular motors and membrane assemblies in conjunction with the distinctive surfaces, rods, dots and materials of nanoscience. - Establishment of a nanobiology training program to integrate the principles of nanoscale science and biology in research and coursework for the development of a new generation of nanobiologists. This will include (i) theoretical courses for PhD and Master students in the fields of biocompatibility of electronic and photonic materials, transformation of bio-signals in electric signals and vice-versa, extra and intracellular bioelectric signaling, biotoxicity and related disciplines; (ii) practical training of young researchers from the IEEN at leading European research centres in the areas of nano-bio, nano-medicine etc. - Training modules will be provided to assist researchers and staff from across Moldova to attain a more efficient and practical understanding of FP7 rules and regulations and receive training to increase success in submitting FP7 proposals.

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**NBR: 266529** **ACRONYM: BY-NANOERA** **EC FUND: 380811**

**DG:** RTD **Call: FP7-INCO-2010-6** **Thema:** INCO.2010-6.1

**Title:** Institutional Development of Applied Nanoelectromagnetics: Belarus in ERA Widening"

**Abstract:** The project aims at reinforcing RTD and cooperation capacities of the Institute for Nuclear Problems of Belarusian State University in the area of applied nanoelectromagnetics. This new research discipline comprising the classical electrodynamics of microwaves and present-day concepts of condensed matter physics is covered by the FP7 Theme 4 'Nanosciences, Nanotechnologies, Materials and new Production Technologies – NMP'. INP BSU is the founder and leading research center in Belarus in this area. Within the project a set of complementary networking and training activities is foreseen with a strong involvement of already existing and new partners from EU member states and associated countries. Besides, based on research results and their applications in material sciences and medicine, and also taking in consideration the emerging socio-economic needs in Belarus and EU, a strategy of the INP BSU further development will be proposed. All together, the activities will support national RTD in applied nanoelectromagnetics, contribute to young researchers' career development, intensify information and experience exchange between Belarus and EU teams thus contributing to creation of the European research network in applied nanoelectromagnetics, as far as increase visibility of INP BSU in the European Research Area and its participation in the FP7. Also, the strategy developed for INP BSU will be proposed and disseminated as a model for the integration of the other Belarus teams into European Research Area.

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**NBR: 266531** **ACRONYM: SUCCESS** **EC FUND: 498872**

**DG:** RTD **Call: FP7-INCO-2010-6** **Thema:** INCO.2010-6.1

**Title:** Strengthening Ukraine and EU research cooperation in the field of Material Sciences

**Abstract:** The 36-months SUCCESS project is based on a twinning approach between one of the leading Ukrainian scientific and educational organisations, the Institute for Scintillation Materials of Academy of Science of Ukraine (ISMA), with their long term partner University Claude Bernard of Lyon (UCBL). The project gives Ukraine the possibility to improve the research activities of their highest quality in the FP7 thematic priority "Nanosciences, nanotechnologies, materials & new production technologies" (NMP), and in particular in the field of Material Sciences. SUCCESS include several main types of activities, thus forming a coherent plan for improving the ISMA' capacities in a number of fields relevant to the FP7 Thematic Priority "NMP": (1) Preparatory and analytical activities: preparation of ISMA Strategic Development Plan based on ISMA SWOT analysis and socio-economic analysis on Ukraine, Eastern Europe and EU level; (2) Twinning activities, based on the twinning and joint research plan to be prepared and implemented jointly by ISMA and UCBL, and linked to the Strategic Development Plan of

ISMA. This activity includes, for example, exchange of researchers and young specialists, organisation of joint scientific workshops, set up of joint research experiments in EU, feasibility study of a joint virtual laboratory ISMA-UCBL and first implementation steps. Sustainability plan will be designed and implemented. (3) International cooperation activities, such as networking & brokerage, ETP and FP7 consortia integration etc, which will be implemented on wide European and regional level, involving other European organisations, thus extending the project impact. (4) Training and coaching activities, that will aim to increase the ISMA' understanding of FP7, build competences and enhance the Institute's participation in FP7. Four peer reviews will be organised by the high level S&T specialists, selected according to a transparent procedure.

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**NBR: 266600** **ACRONYM: NAPEP** **EC FUND: 498322**

**DG:** RTD **Call: FP7-INCO-2010-6** **Thema:** INCO.2010-6.1

**Title:** Nanotecnology platform for electronics and photonics

**Abstract:** The project focuses on creating a nanotechnology platform at Baku State University through cooperation with nanotechnology centers in EU countries which is important for the development of research in nanoelectronics and photonics in the collaborating countries. The project addresses the increasing cooperation capacity between NanoCenter Baku State Uiversity and EU research centers in the area of nanotechnology. Activities have been designed in close co-operation between the three participants: the applicant and the two European universities. Coordination actions in the project will cover activities such as meetings, workshops, seminars, exchanges of researchers, exchange and dissemination of experiences, management of initiatives and joint solving of current research problems. During project implementation good networking relationships and joint research plans will be formed. The partners will continuously evaluate and develop the dissemination activities, negotiating, sharing experiences on meetings and learning best practices from other similar projects. During the whole project the partners will ensure the interactivity and effective cooperation so as to guarantee the adaptation of innovative new results.

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**NBR: 266636** **ACRONYM: GENIS LAB** **EC FUND: 1674932**

**DG:** RTD **Call: FP7-SCIENCE-IN-SOCIETY-2010-1** **Thema:** SiS-2010-2.1.1.1

**Title:** The Gender in Science and Technology LAB â€“ GENIS LAB

**Abstract:** The GENIS – LAB project aims to implement structural changes in a group of selected scientific organisations in order to overcome the factors that limit the participation of

women in research. Our proposal is to create a synergy among scientific partners promoting common actions and best practices exchange in order to defeat gender discrimination, and technical partners providing and sharing innovative tools and methodologies for gender mainstreaming in science. Scientific partners present a focus area on nanotechnologies and an already set network. Besides, two other STEM areas (physics and ITC) are represented in order to provide a comparative assessment as well as best practices. The nine partners are: CSIC (Spanish Superior Council for Scientific Research) Institute for Polymer Science and Technology, Spain; IPF - Leibniz Institute of Polymer Research Dresden, Germany; FTM UB _ Faculty of Technology and Metallurgy, University of Belgrade, Serbia; NIC_National Institute of Chemistry, Slovenia; INFN, National Institute for Nuclear Physics, Italy; BTH_Blekinge Institute of Technology, Sweden. Technical partners are: FGB- Fondazione Giacomo Brodolini, Italy; ITC/ILO_ International Training Centre of the International Labour Organization, UN Agency, International; ADS - Italian women in science organization, Italy. GENIS-LAB will operate on three levels: the organisational level (identification of specific management tools and definition of self tailored action plans aimed to promote internal structural changes); the social/environmental level (promotion of a communication and awareness campaign aimed at fighting against stereotypes - de-constructing the stereotyped relation between women and science); the trans - national European level (promotion of networking/mutual learning among involved scientific organisation to support the exchange of experiences, practices, efficient management tools).

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**NBR: 266660** **ACRONYM: EPOCH** **EC FUND: 1150012**

**DG:** RTD **Call: FP7-SCIENCE-IN-SOCIETY-2010-1** **Thema:** SiS-2010-1.1.1.2

**Title:** Ethics in Public Policy Making: The Case of Human Enhancement

**Abstract:** EPOCH aims both to broaden and deepen knowledge of the role of ethics in the governance of science and technology, focusing on ethical aspects of new and emerging bio-, neuro- and nanotechnologies and specifically related to the topic of human enhancement (i.e. any modification of the human body aimed at improving performance and realized by scientific-technological means). On the basis of comparative analyses of current governance and normative frameworks at European and national level (including non-EU countries), a comprehensive approach to the governance of contentious developments in science, technology and society will be outlined. It will include guidance and strategic options for governance activities in Europe, but also specific proposals regarding public policies on selected enhancement technologies, focusing on physical enhancement in sport. The research will cover (i) academic, policy and public discourses; (ii) the institutional landscape of ethical policy advice; (iii) the multi-disciplinary expertise involved in it; (iv) procedures and mechanisms for a participatory, socially inclusive, and reflexive governance of science and technology; and (v) specific ethical and governance challenges raised by the use of new technologies for

human enhancement. EPOCH aims to generate new insights into the role of ethical expertise in European policy making on science and technology, coherent with national and other European projects. The comprehensive governance approach adopted will facilitate the integration of emerging technologies in an open, effective and democratic knowledge-based society. It will have a strong and critical participatory element, embedded in a broader multidisciplinary and reflexive governance framework. It will also include suggestions on how to foster, in the European Union and beyond, cross-national reflection and well-informed discussions on ethically contentious scientific and technological developments.

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**NBR: 266712** **ACRONYM: MODNANOTOX** **EC FUND: 999899**

**DG:** RTD **Call: FP7-NMP-2010-EU-USA** **Thema:** NMP.2010.1.3-2

**Title:** Modelling nanoparticle toxicity: principles, methods, novel approaches

**Abstract:** ModNanoTox will develop a number of well-documented and technically advanced models describing the behaviour of engineered nanoparticles in organisms and the environment. Background to these models will be a thoroughly documented database, constructed based on: (1) an advanced evaluation of physicochemical properties of nanoparticles and in silico modelling of their reactivity; and (2) assessment of the characterisation methodologies as well as toxicity protocols used to develop biological responses in toxicological studies. At the next level whole datasets will be evaluated for internal consistency and then compared with other relevant sets. The evaluation stage will be followed by development of toxicity models based at the individual organism level, using statistical and mechanistic models, in parallel with models predicting environmental fate. The toxicity and fate models will be integrated in mechanistic models to predict the long term risks of engineered nanoparticles for populations under realistic environmental conditions. The risk assessment models will be developed in close collaboration with appropriate stakeholders and end users to ensure their suitability for practical use in relevant legislative contexts.

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**NBR: 266737** **ACRONYM: NANOTRANSKINETICS** **EC FUND: 993013**

**DG:** RTD **Call: FP7-NMP-2010-EU-USA** **Thema:** NMP.2010.1.3-2

**Title:** Modelling basis and kinetics of nanoparticle interaction with membranes, uptake into cells, and sub-cellular and inter-compartmental transport

**Abstract:** The prediction of biological (and in particular toxicological) impacts has, as its basic pre-requisite, the correct prediction of the sites of action and localization of the nanoparticle

in living organisms. We have identified the need for a paradigm shift in modelling these properties for nanoscale objects. The interactions between bare particles and organisms (cells, biological barriers) is radically different in the presence of proteins and lipids derived from the biological environment (the 'protein corona'). The bare particle characteristic is therefore insufficient to describe the system. Similarly, nanoparticles are trafficked and translocated between sites by active biological processes where traditional 'equilibrium' principles for small molecules no longer apply. NanoTransKinetics is firmly based on advanced high quality experimental data on the distribution of nanoparticles in cells, across barriers, and (more limited) in vivo. We frame phenomenological models in a modular manner by abstracting the essential relevant principles of particle-protein (and matrix) interactions, cellular and barrier transport mechanisms of nanoparticles, fitting them to experimental data. More detailed models allow for explicit checking of mechanisms and movements of individual particles into cells and across barriers. Enormous amounts of experimental data are now available to validate the models. A predictive capacity requires only simple input data on particle, corona and similar characteristics. The basis of these claims has been checked in preliminary studies, and a limited number of interactions, particles fluxes (and control parameters) between prescribed sites are sufficient to specify the system at each level of description. Resources (reaching far beyond the program itself) have been mobilised in experimental work in the Partners laboratories, and EU and US collaborations. The output will be predictive tools for use in nanosafety research and regulation and beyond.

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**NBR: 266765** **ACRONYM: PMELT** **EC FUND: 2168862**

**DG:** ERCEA **Call: ERC-2010-AdG_20100224** **Thema:** ERC-AG-PE5

**Title:** New Frontiers in Protein-based Nanomaterials

**Abstract:** We propose to undertake an ambitious 5 year interdisciplinary programme that introduces a fundamentally new paradigm in protein-based nanomaterials research. The new approach involves two main project themes based respectively on fundamental studies on the structure, function and properties of molten protein polymer surfactant nanoconstructs, and the development of these novel nanomaterials as smart fluids, biotechnological devices and health care products. This proposal represents a new and adventurous area of work for the PI, and will allow unprecedented access to a novel class of nanomaterials with controllable architectures, unique physical properties and inherent biological functionality. In so doing, the work will open up promising new avenues of bionanomaterials research and offer significant advantages over current methods for producing protein-based nanomaterials at extremely high concentration and dosage. In general we expect the research programme to pioneer new frontiers in fundamental research and generate significant economic and societal impact as

nanomaterials become increasingly integrated into medical and technological products, and new commercial markets based on nanoscience are discovered.

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**NBR: 266770** **ACRONYM: MICROMEGAS** **EC FUND: 2418000**

**DG:** ERCEA **Call: ERC-2010-AdG_20100224** **Thema:** ERC-AG-PE3

**Title:** Nanofluidics inside a single carbon nanotube

**Abstract:** Nanofluidics is an emerging field aiming at the exploration of fluid transport at the smallest scales. Taking benefit of the specific properties of fluids in nanoconfinement should allow to challenge the limits of macroscopic continuum frameworks, with the ultimate aim of reaching the efficiency of biological fluidic systems, such as aquaporins. Carbon nanotubes have a decisive role to play in this quest, as suggested by the anomalously large permeabilities of macroscopic carbon nanotube membranes recently measured. This behavior is still not understood, but may be the signature of a 'superlubricating' behavior of water in these nanostructures, associated with a vanishing friction below a critical diameter, a result put forward by our preliminary theoretical results. To hallmark this grounbreaking behavior, it is crucial to go one step beyond and investigate experimentally the fluidic properties inside a single carbon nanotube: this is the aim of this proposal. To this end, the project will tackle two experimental challenges: the integration of a single nanotube in a larger nanofluidic plateform; and the characterization of its fluidic properties. To achieve these tasks, we propose a fully original route to integrate the nanotube in a hierarchical nano to macro fluidic device, as well as state-of-the-art methods to characterize fluid transport at the 'zepto-litter' scale, based on single molecule fluorescence techniques and 'patch-clamp' characterization. In parallel, experimental results will be rationalized using modelization and molecular dynamics. This project will not only provide a thorough fundamental understanding of the properties of carbon nanotubes as fluidic transporter, but also provide an exceptional nanofluidic plateform, allowing to explore the limits of classical (continuum) frameworks. It will also allow to envisage future potential applications, eg for desalination, separation, energy converter, jet printing, ...

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**NBR: 266789** **ACRONYM: NANOFUTURES** **EC FUND: 999980**

**DG:** RTD **Call: FP7-NMP-2010-CSA-4** **Thema:** NMP.2010.4.0-5

**Title:** NANOfutures: a cross-ETP Coordination Initiative on nanotechnology

**Abstract:** NANOfutures CSA aims (1) to identify and optimize synergies between European and National Platforms, research programmes, JTI, ERA-NETs and other CSAs and research

projects related to nanotechnology, in order to reduce the fragmentation of the European nanotechnology and coordinate future strategies. (2) to identify key strategic nanotechnology nodes addressing issues of cross-sectorial and nano-specific relevance for the innovation and rapid uptake of nanotechnologies in order to increase EU competitiveness . (3) to construct and disseminate an integrated Industrial and Research Roadmap for European Nanotechnology. The Roadmap will address European key nodes in terms of cross-sectorial research, technology and innovation issues as well as broad socio-economic challenges to the implementation and commercialisation of sustainable and safe nanotechnology enabled solutions. This target will be achieved in the framework of the NANOfutures Initiative, a cross-ETP, integrating platform that brings together all relevant stakeholder groupings involved in nanotechnology. Project partnership is composed of D'Appolonia, in charge of the coordination, PRODINTEC and NANOfutures Association, which groups together relevant stakeholders. 11 European Technology Platforms have signed a memorandum in support of the initiative, and many industries, including several SMEs, are actively involved in the project activities, including the networking and dissemination tasks. NANOfutures Steering Committee is formed by the representatives of the supporting 11 ETPs plus 10 nanotechnology experts chairing NANOfutures CSA working groups. The CSAs ProNano, NanoCom, ObservatoryNANO and Nano2Market have undertaken to collaborate with NANOfutures in order to increase the effectiveness of the action. This networking activity will secure added value by providing the necessary multidisciplinary and cross-sectorial community able to create a common vision of future European nanotechnology.

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**NBR: 266801** **ACRONYM: MINAM 2.0** **EC FUND: 615200**

**DG:** RTD **Call: FP7-NMP-2010-CSA-4** **Thema:** NMP.2010.4.0-5

**Title:** Paving the ground for the second generation of a highly effective, application oriented MicroNano Manufacturing community in Europe

**Abstract:** MINAM 2.0 will contribute to enabling a new dimension of quality with respect to the cooperation of the single groups in the micro- and nanotechnology (MN) manufacturing. MINAM aims at bringing together existing and well established (local) Micro Nano related organizations: the microclusters in the European regions, networks of Excellence, Associations, Research infrastructures, European projects and decision makers in the MN community. Through regional clusters with their strong industrial backbone MINAM 2.0 considerably contributes to the participation of the industry in European decision processes in this thematic area. The cooperation between MINAM and European application and technology platforms promoted at European level will improve the exchange between application requirements and technical capabilities, aiming at the identification of common objectives and requirements. MINAM will provide a significant contribution to identification of Cross sectional Joint Research agenda (together with other ETP´s) and allows for a derivation of concerted partial

roadmaps for the different thematic areas in MNT (Assembly, Micro/Nanotechnologies, System integration). To obtain sustainability MINAM 2.0 will be established as a “one stop shop” hub for exchanging information, adding value to all players in this area of interest. The hub will also push the improvement of cooperation between the regional key players in the European regions. A close connection to Manufuture, Nanofutures and other ETPs in the NMP area will ensure that double activities are cut down to a minimum and strenghten the production technology as a whole through its specific view on aspect of highly micro relevance, such as precission assembly, characterization, micro sensorics, etc. For the intended target application areas (EUROP, Nanomedicine, Food ...) all this will lead to an improved information flow about new developments in Nano-Microsystems as one of the key enablers for new products

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**NBR: 266810** **ACRONYM: ENF 2011** **EC FUND: 400000**

**DG:** RTD **Call: FP7-NMP-2010-CSA-4** **Thema:** NMP.2010.4.0-6

**Title:** Organisation of EuroNanoForum 2011

**Abstract:** The EuroNanoForum 2011 (ENF 2011) will be organised by the National Office for Research and Technology in Hungary, and will be a prominently featured in the Hungarian EU Presidency programme of 2011. The event wil be organized from 30 May – 1 June, 2011, starting with 2-day conference featuring distinguished speakers to initiate stimulating discussions and exchange ideas on key policy, scientific, industrial and societal issues in nanotechnology. A third day will be dedicated to networking between stakeholders involved in European Technology Platforms to discuss strategic research priorities, and between researchers and industrial actors to initiate future cooperation in research and innovation. The conference will be enriched with a lively accompanying industrial and research exhibition. Furthermore, the EuroNanoForum 2011 will be organized at a critical time in the debate to formulate future strategic priorities in nanotechnology up to 2020 for the next Strategic Nanotechnology Action Plan, and offer input for defining research priorities of the NMP theme of the 8th Framework Programme. ENF 2011 will be held on the eve of the first anniversary of the integrating technology platform, the NANOfutures initiative, and thus ideally aligned to discuss its first propositions for cross-sectoral cooperation needs.

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**NBR: 266851** **ACRONYM: CHEMWATER** **EC FUND: 949296**

**DG:** RTD **Call: FP7-NMP-2010-CSA-4** **Thema:** NMP.2010.4.0-5

**Title:** Coordinating European Strategies on Sustainable Materials, Processes and Emerging Technologies Development in Chemical Process and Water Industry across Technology Platforms

**Abstract:** Europe must use water more efficiently to avoid the anticipated impacts of water shortage driven by a range of dynamics incl. climate change. Nanotechnologies, materials and process innovations (NMP) are key enabling technologies for efficient industrial water management. The chemical industry has a unique role as major water user AND a key solution provider for the development of future water technologies. ChemWater will coordinate EU strategies across and beyond ETPs on sustainable materials, technologies and process development in the chemical and water industries, with the final objective to integrating and exploiting NMP knowledge and technologies addressing the emerging global challenge of sustainable industrial water management. The ChemWater workplan will deliver: Cross-sectoral synergies between key stakeholders (i.e. ETPs, NoEs, ERA-NETs) drawing on knowledge from chemical processes and water technologies. A long term 2050 vision and strategy on technologies and process developments enabling efficient industrial water management that integrates across sectors disciplines and engages the necessary resources and relevant stakeholders. A Joint implementation Action Plan addressing NMP research needs, skills needs, business development opportunities. Specification of those elements and mechanisms required to ensure the rapid uptake and commercialization of enhanced materials, and processes contributing to optimized industrial water management. Establishment and implementation of an effective dissemination strategy to ensure the communication not only of the project objectives and action plans but also best practices, methodologies and common long term strategies. ChemWater provides an opportunity, to promote progressive science-based industry, foster a sustainable European supply industry, contributing to meet the water needs of society and having the potential to provide Europe with a leading position in the growing global NMP-Water market.

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**NBR: 266946** **ACRONYM: NANOCHANNELS** **EC FUND: 797982**

**DG:** RTD **Call: FP7-NMP-2010-CSA-4** **Thema:** NMP.2010.1.1-1

**Title:** Engaging European stakeholders in debating NANOtechnology issues using a range of media CHANNELS

**Abstract:** The NANOCHANNELS partners have created a programme of campaigns and events, designed to engage a wide range of stakeholder groups in an open debate of ELSA issues raised by developments in nanotechnology; a vital step to build a public consensus in nanotechnology issues. The project partners are all experienced professionals from a wide range of disciplines, including major European newspapers, leading educationalists and polling specialists. Their combined expertise has enabled an well targeted, effective

programme to be prepared. The coordinator and two other partners are leading the successful FP7 NANOYOU project, which aims to inform and engage European youth in NT issues. This experience has been the starting point for the NANOCHANNELS project. The campaign and events programme designed by the partners will use a range of media tools selected to reach a wide range of different stakeholder groups. Traditional media, including press and radio, and youth-oriented, web-based tools will be combined with live events to engage the lay public, scientists, NGOs, educators and other stakeholders. A series of debates will take place in schools throughout the EU, and a high-profile round table will be held. A unique feature of the programme will be the inclusion of school students in producing much of the media content. They will be mentored by professional journalists who will produce the balance of the material to ensure suitability for all stakeholders. Throughout the project, a series of surveys and polls will take place. Changes in opinion that take place after the campaign will be recorded. This data will be compiled and used to assess public attitudes, and determine the emerging public consensus. At the end of the project, a report will be issued to the Commission which will provide recommendations for: • creating a process to facilitate better governance of NT issues • a future education policy • EU action plan for nano technology and action plans

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**NBR: 267099** **ACRONYM: ATMOPACS** **EC FUND: 2496000**

**DG:** ERCEA **Call: ERC-2010-AdG_20100224** **Thema:** ERC-AG-PE10

**Title:** Atmospheric Organic Particulate Matter, Air Quality and Climate Change Studies

**Abstract:** Despite its importance for human health and climate change organic aerosol (OA) remains one of the least understood aspects of atmospheric chemistry. We propose to develop an innovative new framework for the description of OA in chemical transport and climate models that will be able to overcome the challenges posed by the chemical complexity of OA while capturing its essential features. The objectives of ATMOPACS are: (i) The development of a new unified framework for the description of OA based on its two most important parameters: volatility and oxygen content. (ii) The development of measurement techniques for the volatility distribution and oxygen content distribution of OA. This will allow the experimental characterization of OA in this new “coordinate system”. (iii) The study of the major OA processes (partitioning, chemical aging, hygroscopicity, CCN formation, nucleation) in this new framework combining lab and field measurements. (iv) The development and evaluation of the next generation of regional and global CTMs using the above framework. (v) The quantification of the importance of the various sources and formation pathways of OA in Europe and the world, of the sensitivity of OA to emission control strategies, and its role in the direct and indirect effects of aerosols on climate. The proposed work involves a combination of laboratory measurements, field measurements including novel “atmospheric perturbation experiments”, OA model development, and modelling in urban, regional,

and global scales. Therefore, it will span the system scales starting from the nanoscale to the global. The modelling tools that will be developed will be made available to all other research groups.

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**NBR: 267129** **ACRONYM: SUPRANANO** **EC FUND: 2133990**

**DG:** ERCEA **Call: ERC-2010-AdG_20100224** **Thema:** ERC-AG-PE4

**Title:** From metal nanocrystal to supracrystal:crystallinity at nanometer and micrometer scales

**Abstract:** The Applicant has an outstanding record of achievement and an international reputation for independent research in many areas of physical chemistry and more specifically over the last 25 years in nanosciences. This large expertise makes it possible, through this project, to come to a decisive turning point in her career. This high-impact and challenging proposal brings together innovative ideas in nanomaterials within a single inter- and multi-disciplinary project to open up new horizons across materials science. The challenging and innovating issue of this project consists in authenticating and detailing the emergence of new chemical and physical properties directly related to the ordering of atoms in nanocrystals (nanocrystallinity) and the ordering of nanocrystals in supracrystals (supracrystallinity). Au, Ag, and Co nanocrystals with different nanocrystallinities (single domain, multiply-twinned and polycrystalline particles) will be synthesized by new methods. Nanocrystals will be used to produce supracrystals of these metals with different supracrystallinities (fcc, hcp, or bcc). The influence of nanocrystallinity on the diffusivity of different atoms within Ag and Co nanocrystals will be investigated. Physical properties of both nanocrystals and supracrystals such as the vibrational, electronic and mechanical properties and their dependence on crystallinity will be explored. From the data thus obtained it should be possible to point out analogies between the properties of atoms in nanocrystals or in the bulk phase and those of nanocrystals ordered in supracrystals. Moreover, correlations between the studied properties could emerge. This research will result in important scientific knowledge and may ultimately open new technological applications.

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**NBR: 267160** **ACRONYM: NANOGRAPH** **EC FUND: 2500000**

**DG:** ERCEA **Call: ERC-2010-AdG_20100224** **Thema:** ERC-AG-PE5

**Title:** The Chemists Way of Making and Utilizing Perfect Graphenes

**Abstract:** Graphenes, single sheets of graphite, hold enormous promise as a material of the future, since their unique electronic properties might allow us to combine advantages of silicon and plastics. We propose a concept for the synthesis and processing of mono- and

multilayered graphenes and of graphene nanoribbons (GNRs), which are strips of graphene exhibiting a high aspect ratio. The key idea is the dehydrogenation (and planarization) of precursor molecules made from twisted benzene rings. Size and shape of the final graphenes will be chemically determined by the precursors themselves, which can be synthesized with great perfection. This elegant level of structural control of graphenes and GNRs discriminates our approach against existing literature efforts. Defined edges of GNRs are essential for creating finite electronic band gaps, since pristine graphene is a semimetal and thus not suitable for most electronic and optoelectronic applications. Graphenes at a size of several hundred nm will be targeted in solution, but mainly after deposition and transformation of the precursor molecules on substrate surfaces. The consequence is that we will apply and combine organic polymer synthesis and processing with methods of surface physics to create a new materials science of graphenes. Further characteristics of the work will include in-situ monitoring of chemical processes by scanning probe methods and interfacing of as-formed graphenes for in-situ measurements of charge carrier mobility and spin transport. Applications will be demonstrated for the construction of batteries, fuel cells, field effect transistors, and sensors. What we expect as key achievements will be the delineation of reliable structure-property relationships and improved device performance of graphene materials.

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**NBR: 267166** **ACRONYM: PHYSBOIL** **EC FUND: 2108000**

**DG:** ERCEA **Call: ERC-2010-AdG_20100224** **Thema:** ERC-AG-PE3

**Title:** Physics of liquid-vapor phase transition

**Abstract:** Liquid-vapor phase transitions and boiling are omnipresent in science and technology, but, as far as basic understanding of the hydrodynamics, these phenomena remain "terra incognita''. The objective of the proposed work is to achieve a fundamental understanding of the fluid dynamics and heat transfer of the liquid-vapor phase transition - in particular of boiling - both on a micro- and on a macro-scale, through experiments under well-defined and controlled conditions, accompanied by theoretical and numerical modeling. Up to now "boiling'' has been nearly exclusively an engineering subject. We want to change this and make it a physics subject as we are convinced that boiling involves very interesting and practically relevant physics still in need of understanding. On the micro-scale the planned experiments include nucleation studies of individual and interacting vapor bubbles on superheated, geometrically and chemically micro- and nano-structured surfaces. In the bulk of the flow, nucleation will be achieved through laser heating, through local pressure gradients, and through acoustically triggered vaporization of metastable perfluorcarbon nanodroplets in a superheated liquid. The vapor bubbles will be monitored with ultra-high-speed digital imaging, micro particle velocimetry, infrared thermography, and heat flux measurements. On the theoretical side we will use molecular dynamics simulations and

the level-set method. On the macro-scale the focus is on closed boiling turbulent flows, namely Rayleigh-Benard and Taylor-Couette flow. We will measure how the vapor bubble formation affects global quantities such as the heat flux and the angular momentum flux and thus the drag, and local flow properties such as the vapor bubble concentration. The numerical simulations, with one generic code for both geometries, will be based on discrete particle models.

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**NBR: 267173** **ACRONYM: DNA MACHINES** **EC FUND: 2499522**

**DG:** ERCEA **Call: ERC-2010-AdG_20100224** **Thema:** ERC-AG-PE5

**Title:** Nanomachines based on interlocked DNA architectures

**Abstract:** DNA-nanotechnology has created different topologies, including replicable ones, nanomachines, patterns, logic gates, or algorithmic assemblies. Interlocked double-stranded (ds) DNA-architectures like catenanes or rotaxanes, wherein individual components can be set in motion in a controlled manner have not been accessible. These molecules represent long-sought devices for nanorobotics and nanomechanics because they possess a unique mechanical bonding motif, not available to conventional building blocks. The project will apply an unprecedented, simple, and modular interlocking paradigm for double-stranded (ds) circular DNA geometries that we have developed in preliminary studies. This will now be taken several crucial steps forward by generating unconventional DNA-, protein-, aptamer-, and ribozyme hybrid architectures containing interlocked structures wherein the motion of individual components can be controlled in many different ways. We will design, construct, and evaluate switchable autonomous DNA-nanomachines that function as rotational motors, muscles, or switches for powering and manipulating nanoscale components. The DNA machines envisaged in this project will be applied, for example, in synthetic supramolecular self-assembly systems that emulate complex biological machines like motor proteins, nucleic acid polymerases, or ATPases. In addition, they will be developed for multiple purposes in biosensing, logic-gate- and memory circuit assembly, and catalysis. This efficient method for constructing interlocked dsDNA nanostructures opens the exciting possibility of conjoining the area of lifesciences with that of nanomechanical engineering, paving entirely new avenues for nanotechnology. The project is highly interdisciplinary and will open a new field with enormous innovative potential and implications ranging from chemistry to synthetic biology, and from the life sciences to nano-engineering.

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**NBR: 267229** **ACRONYM: ICFONEST** **EC FUND: 842900**

**DG:** REA **Call: FP7-PEOPLE-2010-COFUND** **Thema:** FP7-PEOPLE-2010-COFUND

**Title:** ICFONest International Postdoctoral Program

**Abstract:** The ICFONest Post-doctoral program aims to provide high-level training and support for 14 outstanding international researchers in the early stages of their careers, working in the field of Photonics. ICFO will provide cutting edge facilities as well as a stimulating, international and interdisciplinary environment to help Fellows become successful independent researchers. ICFO currently hosts 20 research groups working in 50 different laboratories. Available to them are a nanofabrication cleanroom and a range of other support facilities. All research groups and facilities are located in a dedicated 10.000 m2 -building situated in the Mediterranean Technology Park in the metropolitan area of Barcelona. Currently, ICFO counts about 200 researchers, a number that is continuously growing. By 2014, when ICFO completes its ongoing expansion phase, the Institute will count more than 300 researchers working in 25 different research groups. Research at ICFO encompasses four broad thematic areas: nonlinear photonics, quantum photonics, nanophotonics, and biophotonics. Researchers work in a great variety of fields, including quantum information technologies, nanophotonic devices, remote sensors, optoelectronics, integrated optics, ultrafast optics, biophotonics, and biomedical optics. Projects are run as part of both medium- and long-term programs. The ICFONest COFUND program will run for four years and during this time it will support rising top-class researchers with excellent facilities, competitive salaries, research expenses and support from Group Leaders. During the period, the program will award 14 outstanding post-doctorate researchers with INCOMING Fellowships. ICFO will also offer specialised business courses and complementary training programs as well as a wide range of events, seminars and colloquia involving world-renowned scientists.

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**NBR: 267234** **ACRONYM: GRINDOOR** **EC FUND: 2328726**

**DG:** ERCEA **Call: ERC-2010-AdG_20100224** **Thema:** ERC-AG-PE5

**Title:** Green Nanotechnology for the Indoor Environment

**Abstract:** The GRINDOOR project aims at developing and implementing new materials that enable huge energy savings in buildings and improve the quality of the indoor environment. About 40% of the primary energy, and 70% of the electricity, is used in buildings, and therefore the outcome of this project can have an impact on the long-term energy demand in the EU and the World. It is a highly focused study on new nanomaterials based on some transition metal oxides, which are used for four interrelated applications related to indoor lighting and indoor air: (i) electrochromic coatings are integrated in devices and used in “smart windows” to regulate the inflow of visible light and solar energy in order to minimize air condition and create indoor comfort, (ii) thermochromic nanoparticulate coatings are used on windows to provide large temperature-dependent control of the inflow of infrared solar radiation (in stand-alone cases as well as in conjunction with electrochromics), (iii) oxide-based gas sensors are used to measure

indoor air quality especially with regard to formaldehyde, and (iv) photocatalytic coatings are used for indoor air cleaning. The investigated materials have many things in common and a joint and focused study, such as the one proposed here, will generate important new knowledge that can be transferred between the various sub-projects. The new oxide materials are prepared by advanced reactive gas deposition—using unique equipment—and high-pressure reactive dc magnetron sputtering. The materials are characterized and investigated by a wide range of state-of-the-art techniques.

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**NBR: 267254** **ACRONYM: BIOMATE** **EC FUND: 2497044**

**DG:** ERCEA **Call: ERC-2010-AdG_20100224** **Thema:** ERC-AG-ID1

**Title:** Soft Biomade Materials: Modular Protein Polymers and their nano-assemblies

**Abstract:** From a polymer chemistry perspective, the way in which nature produces its plethora of different proteins is a miracle of precision: the synthesis of each single molecule is directed by the sequence information chemically coded in DNA. The present state of recombinant DNA technology should in principle allow us to make genes that code for entirely new, very sophisticated amino acid polymers, which are chosen and designed by man to serve as new polymer materials. It has been shown that it is indeed possible to make use of the protein biosynthetic machinery and produce such de novo protein polymers, but it is not clear what their potentials are in terms of new materials with desired functionalities. I propose to develop a new class of protein polymers, chosen such that they form nanostructured materials by triggered folding and multimolecular assembly. The plan is based on three innovative ideas: (i) each new protein polymer will be constructed from a limited set of selected amino acid sequences, called modules (hence the term modular protein polymers) (ii) new, high-yield fermentation strategies will be developed so that polymers will become available in significant quantities for evaluation and application; (iii) the design of modular protein polymers is carried out as a cyclic process in which sequence selection, construction of artificial genes, optimisation of fermentation for high yield, studying polymer folding and assembly, and modelling of the nanostructure by molecular simulation are all logically connected, allowing efficient selection of target sequences. This project is a cross-road. It brings together biotechnology and polymer science, creating a unique set of biomaterials for medical and pharmaceutical use, that can be easily extended into a manifold of biofunctional materials. Moreover, it will provide us with fresh tools and valuable insights to tackle the subtle relations between protein sequence and folding.

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**NBR: 267374** **ACRONYM: DYNAMO** **EC FUND: 1877497**

**DG:** ERCEA **Call: ERC-2010-AdG_20100224** **Thema:** ERC-AG-PE4

**Title:** Dynamical processes in open quantum systems: pushing the frontiers of theoretical spectroscopy

**Abstract:** Scope "Energy Materials. In this project we develop new concepts for building a novel theoretical framework (the ab-initio non-equilibrium dynamical modelling tool") for understanding, identifying, and quantifying the different contributions to energy harvesting and storage as well as describing transport mechanisms in natural light harvesting complexes, photovoltaic materials, fluorescent proteins and artificial (nanostructured) devices by means of theories of open quantum systems, non-equilibrium processes and electronic structure. We address cutting-edge applications along three major scientific challenges: i) characterize matter out of equilibrium, ii) control material processes at the electronic level and tailor material properties, iii) master energy and information on the nanoscale. The long-term goal is developing a set of theoretical tools for the quantitative prediction of energy transfer phenomena in real systems. We will provide answers to the following questions: What are the design principles from the environment-assisted quantum transport in photosynthetic organisms that can be transferred to nanostructured materials such as organic photovoltaic materials and biomimetic materials? What are the fundamental limits of excitonic transport properties such as exciton diffusion lengths and recombination rates? What is the role of quantum coherence in the energy transport in photosynthetic complexes and photovoltaic materials? What is the role of spatial confinement in water and proton transfer through porous membranes (nano-capillarity)? The ground-breaking nature of the project lies in being the first systematic development and application of the theories of open quantum systems and quantum optimal control within an ab-initio framework (time-dependent-density functional theory). The project will open new methodological, applicative and theoretical horizons of research.

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**NBR: 267405** **ACRONYM: HYMEM** **EC FUND: 2368320**

**DG:** ERCEA **Call: ERC-2010-AdG_20100224** **Thema:** ERC-AG-PE4

**Title:** Hybrid Nanosystems in phospholipid membranes

**Abstract:** The cell membrane is the biological platform for many vital processes such as photosynthesis, cell-cell contact, biomolecular recognition, endocytosis and ion transport. Artificial phospholipid membranes play an important role in unravelling the physical and chemical characteristics of membranes and their microscopic role in membrane function. On the other hand a manifold of novel hybrid nanosystems consisting of different nano-objects and exhibiting specific physical and chemical functions have been developed. This proposal aims at incorporating hybrid nanoparticle systems with specific optical functions into artificial and cell membranes in order to

build up a nanophotonic toolbox for nanoscopic optical manipulators, local spectroscopic studies and the combination of both. This nanophotonic toolbox for membranes will open up novel strategies for the optical control of membrane function, the controlled optothermal release and lateral guiding as well as the local spectroscopy and analysis of biomolecules. The planned toolbox also contains new optical concepts for transfection and drug delivery.

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**NBR: 267414** **ACRONYM: NORDIA** **EC FUND: 2121295**

**DG:** ERCEA **Call: ERC-2010-AdG_20100224** **Thema:** ERC-AG-PE6

**Title:** Non-Rigid Shape Reconstruction and Deformation Analysis

**Abstract:** Deformable and non-rigid objects, both natural and artificial, surround us at all scales from nano to macro, and play an important role in many applications ranging from medical image analysis to robotics and gaming. Such applications require the ability to acquire, reconstruct, analyze, and synthesize non-rigid three-dimensional shapes. These procedures pose challenging problems both theoretically and practically due to the vast number of degrees of freedom involved in non-rigid deformations. While modelling and analysis of non-rigid shapes has greatly advanced in the past decade, existing solutions are largely based on parametric models restricting the objects of interest to a narrow class of similar shapes. Broadly speaking, reconstruction, analysis, and synthesis of arbitrary deformable shapes remain unsolved problems, a practical solution of which would be a major milestone in computer vision and related fields. This proposal aims at answering these fundamental questions by adopting tools from modern metric geometry, a field of theoretical mathematics which in the past few decades has undergone a series of revolutions that remained largely unnoticed and unused in applied sciences. We believe that metric geometry tools could systematically answer these questions, and, coupled with modern numerical optimization techniques and novel hardware architectures, pave the computational way to the next generation in deformable shape analysis. We plan to develop such numerical tools while demonstrating their efficiency on several challenging real-life applications such as surgery prediction and planning, biometry, and computer-aided diagnosis.

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**NBR: 267436** **ACRONYM: 3-TOP** **EC FUND: 2419590**

**DG:** ERCEA **Call: ERC-2010-AdG_20100224** **Thema:** ERC-AG-PE3

**Title:** Exploring the physics of 3-dimensional topological insulators

**Abstract:** Topological insulators constitute a novel class of materials where the topological details of the bulk band structure induce a robust surface state on the edges of the material. While transport data for 2-dimensional topological insulators have recently become available, experiments on their 3-dimensional counterparts are mainly limited to photoelectron spectroscopy. At the same time, a plethora of interesting novel physical phenomena have been predicted to occur in such systems. In this proposal, we sketch an approach to tackle the transport and magnetic properties of the surface states in these materials. This starts with high quality layer growth, using molecular beam epitaxy, of bulk layers of HgTe, Bi2Se3 and Bi2Te3, which are the prime candidates to show the novel physics expected in this field. The existence of the relevant surface states will be assessed spectroscopically, but from there on research will focus on fabricating and characterizing nanostructures designed to elucidate the transport and magnetic properties of the topological surfaces using electrical, optical and scanning probe techniques. Apart from a general characterization of the Dirac band structure of the surface states, research will focus on the predicted magnetic monopole-like response of the system to an electrical test charge. In addition, much effort will be devoted to contacting the surface state with superconducting and magnetic top layers, with the final aim of demonstrating Majorana fermion behavior. As a final benefit, growth of thin high quality thin Bi2Se3 or Bi2Te3 layers could allow for a demonstration of the (2-dimensional) quantum spin Hall effect at room temperature - offering a road map to dissipation-less transport for the semiconductor industry.

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**NBR: 267454** **ACRONYM: ROCOCO** **EC FUND: 2426106**

**DG:** ERCEA **Call: ERC-2010-AdG_20100224** **Thema:** ERC-AG-PE5

**Title:** CONFORMATIONAL COMMUNICATION AND CONTROL

**Abstract:** We aim to offer to science a molecular scale mechanism for communication and control. Using stereochemical information and conformational control as the mechanism by which that information is transmitted and processed, we take inspiration from the phenomenon of allostery in biology, and will put to dynamic use a set of conformationally controlled foldamer structures. We will use these structures to convey information over multi-nanometre distances, allowing control of chemical function from a remote site. By embedding the foldamers into membranes, we will control chemistry (eg catalytic activity) within an artificial vesicle by communicating information through the chemically impermeable phospholipid bilayer. To achieve our aim we will synthesise oligomeric and polymeric compounds with well-defined helical conformations, and use a stereochemical influence located at one terminus to induce a conformational preference (for the left or the right handed form of the helix) which is relayed to a site many nanometres distant. Precedent suggests that by employing polymeric structures we will achieve control even over micrometre scales. Simple but powerful new techniques will quantify the remote (on a molecular scale) transmission of information by NMR, circular

dichroism spectrophotometry and/or fluorescence. The result of the information relay will be a detectable change in chemical reactivity or binding properties and one aim will be to vastly increase, by orders of magnitude, the distance over which remote stereochemical control is possible (from the current 2.5 nm to the order of >100 nm). The feature which distinguishes biology from chemistry is information, and in particular the ability to encode and process information using molecular interactions. Our project will take a step towards the development of designed chemical structures which can mimic, using far simpler molecules, the function of biological communication systems.

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**NBR: 267464** **ACRONYM: SPDMETALS** **EC FUND: 2300000**

**DG:** ERCEA **Call: ERC-2010-AdG_20100224** **Thema:** ERC-AG-PE8

**Title:** Using Severe Plastic Deformation for the Processing of Bulk Nanostructured Metals

**Abstract:** The processing of metals through the application of severe plastic deformation (SPD) provides an opportunity for achieving exceptional grain refinement to the submicrometer or the nanometer range. This grain refinement cannot be achieved by conventional methods and it introduces both significant strength and a potential superplastic forming capability. The two most important SPD techniques are Equal-Channel Angular Pressing (ECAP) and High-Pressure Torsion (HPT). In both procedures, very high strains are imposed without introducing any significant changes in the overall dimensions of the samples. This proposal outlines a research programme based on these techniques. Although processing by ECAP and HPT has attracted considerable attention, there have been few attempts to make use of this technology for the fabrication of commercial products. There are several reasons for this omission. First, both techniques produce materials having high strength but limited ductility. Second, ECAP is a labour-intensive process that must be adapted to provide a continuous processing capability. Third, the flow processes are not understood and recent experiments using HPT show remarkable similarities to fluid flow and plasma turbulence. We will take advantage of the ERC Advanced Grant to investigate these areas with three overall objectives. First, to provide an understanding of the flow processes and the microstructural evolution occurring in metals when using these techniques. Second, to develop procedures for the successful utilisation of these techniques in manufacturing. Third, to evaluate the potential for producing super-strong solids by combining HPT with a surface mechanical attrition treatment to introduce a hard surface layer of nanostructured grains.

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**NBR: 267528** **ACRONYM: XMEMS** **EC FUND: 2279800**

**DG:** ERCEA **Call: ERC-2010-AdG_20100224** **Thema:** ERC-AG-PE8

**Title:** Towards Cost-Efficient Flexible Heterogeneous Integration for Micro- and Nanosystem Fabrication

**Abstract:** This proposal targets the development of flexible heterogeneous integration schemes for combining best-of-class materials, components and manufacturing methods into economically viable micro- and nanosystem (MEMS) solutions. Today, the IC industry drives the development of most micro- and nanofabrication technologies, which are characterized by standardized processes, very large production volumes of >10.000 wafers/month and enormous capital investments. In contrast, the vast majority of MEMS demand production volumes of

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**NBR: 267574** **ACRONYM: NANOSENSOMACH** **EC FUND: 2167400**

**DG:** ERCEA **Call: ERC-2010-AdG_20100224** **Thema:** ERC-AG-PE5

**Title:** Nanoengineered Nanoparticles and Quantum Dots for Sensor and Machinery Applications

**Abstract:** Chemically modified metallic nanoparticles (NPs) or semiconductor quantum dots (QDs) are central components for the future development of nanotechnology and nanobiotechnology. This program aims to introduce new dimensions into the field of nanotechnology and nanobiotechnology by synthesizing, characterizing and assembling molecule- or biomolecule-modified nanoparticles (NPs)/Quantum dots (QDs) hybrid nanostructures that perform tailored and programmable functionalities. The project will include two complementary research activities. One direction will include the generation of electropolymerized ligand-functionalized Au NPs matrices on electrode surfaces. By tethering of appropriate ligands to the NPs, imprinted matrices for selective sensing, and signal-triggered NPs "sponges" for the selective uptake and release of substrates will be designed. Also, electrochemically induced pH changes by the NPs matrices will be used to control chemical reactivity (e.g., sol-gel transitions, activation of the ATP synthase machinery). The second research direction will implement ligand-modified QDs for the sensing of ions or molecular substrates. Similarly, nucleic acid-functionalized QDs will be used to develop new versatile sensing platforms exhibiting multiplexed analysis capabilities. One platform will include the quenching of the QDs by G-quadruplexes, whereas the second platform will use biochemiluminescence resonance energy transfer (BRET) as readout signal. Also, QDs-modified supramolecular DNA nanostructures will be designed to perform programmed machinery functions such as "bi-pedal walker", "seesaw", "gear" or "tweezers", and the machinery functions will be transduced by the optical properties of the QDs. Finally, DNA-machines that trigger the isothermal amplified replication of the analyzed nucleic acid will be designed, and QDs tethered to the machine will optically transduce the replication process at real-time.

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**NBR: 267626** **ACRONYM: HECTOR** **EC FUND: 1851178**

**DG:** ERCEA **Call: ERC-2010-AdG_20100224** **Thema:** ERC-AG-PE8

**Title:** MICROWAVE-ASSISTED MICROREACTORS: DEVELOPMENT OF A HIGHLY EFFICIENT GAS PHASE CONTACTOR WITH DIRECT CATALYST HEATING

**Abstract:** While heterogeneous catalysis is often considered a mature science, the so-called enabling technologies are often able to produce significant enhancements in the rate of reaction or in the selectivity towards a given product. Two of these enabling technologies constitute the focal point of this project, where nonclassical energy input by microwave iradiation and alternative reaction engineering (microreactors operating under a stable solid-gas temperature gap) will be used to obtain substantial improvements in the yield or in the energy efficiency of chemical processes. This project aims for a breakthrough in reactor engineering by developing a new type of heterogeneous catalytic reactor, capable of operating under a controlled solid-gas temperature difference. To implement this innovative technology, we will deploy different materials that are sensitive to microwave radiation (zeolite films with/without deposition of metallic particles, metallic films and nanoparticles) on the channels of microreactors made of materials that are transparent to microwaves. A basic study of adsorption and heating processes under microwave irradiation will lead to the selection of materials and conditions that enable operation under a significant temperature difference between the catalyst and the gas phase. The advantages obtained from this novel concept will be exploited in specific, industrially important, reaction processes (CO oxidation in H2 streams; VOC combustion in lean mixtures; ethylene epoxidation), where significant improvements in reaction yield and/or operating costs are expected. At the same time, new scientific and technological insight will be gained in the area of catalyst heating by microwaves.

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**NBR: 267634** **ACRONYM: PLASMETA** **EC FUND: 2286000**

**DG:** ERCEA **Call: ERC-2010-AdG_20100224** **Thema:** ERC-AG-PE3

**Title:** Plasmonic Metamaterials

**Abstract:** IIn this program I will demonstrate control of light at length scales well below the free-space wavelength, leading to entirely new fundamental phenomena and important applications. The research program is built on specially engineered metamaterials composed of metal nanostructures that support surface plasmons that are embedded in a dielectric. The program is composed of three strongly related topics: 1) I will experimentally demonstrate an entirely new class of optical metamaterials that posses a refractive index that can be tuned over a very large range: -10< n< +10. Based on

coupled plasmonic waveguides, these materials will, for the first time, show true left-handed behaviour of light (n< 0) in the UV/blue spectral range. I will demonstrate negative refraction of light and use these materials to demonstrate the “perfect lens” which enables sub-wavelength imaging of (biological) nanostructures. 2) I will use plasmonic metamaterials to engineer the flow of light in thin-film solar cells. By controlling the scattering and trapping of light using plasmonic nanostructures integrated with semiconductor waveguide slabs I will demonstrate ultra-thin solar cells with efficient collection and conversion of infrared light, aiming at beating the ergodic light trapping limit. 3) I will demonstrate strong coupling between light and mechanical motion in the smallest possible volume. Light trapped in plasmonic metamaterials exerts a force that can lead to a shift in the plasmonic resonance frequency which in turn provides feedback on the mechanical motion. We will use this nanoscale coupling mechanism to actively cool and heat mechanical motion in plasmonic nanostructures and use this phenomenon in a new type of plasmon-based quartz oscillator.

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**NBR: 267746** **ACRONYM: MOLNANOMAS** **EC FUND: 2269200**

**DG:** ERCEA **Call: ERC-2010-AdG_20100224** **Thema:** ERC-AG-PE3

**Title:** Molecular Nanomagnets at Surfaces: Novel Phenomena for Spin-based Technologies

**Abstract:** Molecular nanomagnets, also known as Single Molecule Magnets (SMMs), are a class of molecules that at low temperature exhibit magnetic hysteresis of pure molecular origin and not related to a cooperative effect. In the past fifteen years they have attracted great interest for their potentiality to act as magnetic memory units and for the many quantum effects in the dynamics of their magnetization. Recently our observation that the magnetic bistability is retained when a tetranuclear iron(III) molecular cluster is grafted to a metallic surface has renewed the interest in these materials, which appear the ideal candidates for fundamental investigations on the interplay between conducting electrons and magnetic degrees of freedom in the emerging field of molecular spintronics. In this project we plan to benefit from our leading position in the research on SMMs to explore novel phenomena originated by the combination of SMMs with conducting and magnetic substrates in hybrid structures. Our interdisciplinary approach starts from the design and synthesis of SMMs and includes their assembling on surface from solution or in high vacuum as well as the tuning of the interaction with conducting, and magnetic substrates through chemical tuning of SMMs. We will focus on the quantum dynamics of the magnetization that seems particularly affected by the interaction with a magnetic substrate opening perspectives for novel spintronic devices and for an unexplored strategy to increase the blocking temperature of SMMs. Additional aspects will be investigated, in particular the use of switchable magnetic molecules as well as the possibility to modify the interface with yet unexplored approaches, for instance exploiting the magnetic torque on molecules with large magnetic anisotropy.

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**NBR: 267833** **ACRONYM: NANOCELLIMAGE** **EC FUND: 2491881**

**DG:** ERCEA **Call: ERC-2010-AdG_20100224** **Thema:** ERC-AG-PE4

**Title:** Ultrasmall Chemical Imaging of Cells and Vesicular Release

**Abstract:** The long-term goal of this research is to establish the chain of molecular events associated with (1) neurotransmitter release at the single cell and subcellular level and (2) with cell differentiation and reprogramming. These are incredibly important goals for which there are few analytical chemistry methods that are available and useful. The immediate goal therefore includes development of three chemical methodologies at the cutting edge of analytical chemistry: 1) the development of arrays of nanometer electrodes that can be used to spatially measure the release of easily oxidized substances across the cell surface; 2) to improve the combination of MALDI and cluster SIMS ion sources on an orthogonal QStar instrument to enable protein and glycoprotein analysis at the single whole cell level, lipid domain analysis at the subcellular level, and importantly, depth profiling; and 3) the application of information discovered at single cells and of the methods developed in goals 1 and 2 to an in vitro model of cell-to-cell communication and regeneration. I intend to build on my expertise in both electrochemistry and SIMS imaging to develop these approaches. The work described here constitutes two new directions of research in my group as well as new analytical chemistry, and, if successful, will lead to researchers being able to gather incredibly important new data about cell-to-cell communication and cell differentiation and reprogramming as well as to a better understanding the role of lipids in exocytosis and endocytosis.

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**NBR: 267853** **ACRONYM: INSPECTRA** **EC FUND: 2183000**

**DG:** ERCEA **Call: ERC-2010-AdG_20100224** **Thema:** ERC-AG-PE7

**Title:** Silicon-photonics-based laser spectroscopy platform: towards a paradigm shift in environmental monitoring and health care

**Abstract:** The Principal Investigator and his team will open up new horizons in the field of laser spectroscopy through basic research on silicon-photonics-based Spectroscopic Systems-On-Chip (SpecSOC's). The key question being addressed is: how can the powerful concepts of high-index-contrast nanophotonics be combined with the extreme accuracy of silicon technology and with the performance of hybrid silicon/III-V integration in order to create system-on-chip functionalities for advanced (bio-)spectroscopy. We will first focus research on integrated lasers or Laser Systems-on-Chip (LaSOC's) capable of

providing very wide wavelength tuning in the infrared, mid-infrared or visible. These lasers will have an unprecedented combination of properties. They will differ from existing semiconductor lasers in the sense that they combine the best of III-V semiconductor technology and silicon technology in unique cavity structures exploiting high index contrast in three dimensions. In the second phase of the project we will shift the focus from laser-oriented novelty to spectroscopy-oriented novelty and investigate SpecSOC's with an unprecedented system performance that matches the requirements of mainstream real-life spectroscopy. We will explore coherent optical detection techniques for sensitivity enhancement, microporous coatings for on-chip gas sensing and implant-oriented tissue spectroscopy. Our research will lead to a paradigm shift in laser spectroscopy, in the sense that it will turn an advanced spectroscopy system into a small form-factor commodity system. This will have an enormous impact on applications such as point-of-care medical diagnosis and medical implants, monitoring of air, water and food quality. Furthermore the on-chip spectroscopy systems will be highly valuable for fundamental research.

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**NBR: 267867** **ACRONYM: PLASMAQUO** **EC FUND: 2247629**

**DG:** ERCEA **Call: ERC-2010-AdG_20100224** **Thema:** ERC-AG-PE5

**Title:** Development of plasmonic quorum sensors for understanding bacterial-eukaryotic cell relations

**Abstract:** This proposal aims at the development of novel nanostructured materials based on crystalline assemblies of anisotropic plasmonic (gold/silver) nanoparticles, to be used for the surface enhanced Raman scattering (SERS) detection of quorum sensing (QS) signaling molecules, and to the demonstration of applications of such materials to monitor population kinetics in bacterial colonies and the determination of the interaction mechanisms between mixed colonies and their manipulation through external parameters. This will involve a first stage related to the careful design of the most appropriate nanoparticle morphology and composition, as well as an understanding of their specific assembly processes (both on substrates and in solution), so that the collective plasmonic response will be optimized towards the enhancement of the Raman signal of the probe molecular codes. Coating of the nanoparticle supercrystals with a mesoporous layer will be required to protect them against contact with bacteria and cells, while permitting contact with the QS signaling molecules. Ultimately, when the sensing system has been optimized and its performance demonstrated for monitoring of QS signals and colony growth, two final and important goals will be pursued. First, the interaction between mixed colonies (bacteria-bacteria and bacteria-eukaryotic cell) will be monitored in order to get information about synergic or antagonist (toxicity) QS mechanisms during the growth and proliferation of different bacteria and interspecies. This goal will permit the design of in vitro experiments where a bacterial strain may be manipulated by means of external

introduction of the appropriate QS signaling molecules. Finally, the major challenge will be the practical demonstration of the ability of these new materials in this particular configuration for understanding and manipulating the growth and communication of different types of prokaryotic and peukaryotic cells.

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**NBR: 267922** **ACRONYM: NEMINTEM** **EC FUND: 2500000**

**DG:** ERCEA **Call: ERC-2010-AdG_20100224** **Thema:** ERC-AG-PE5

**Title:** In-situ NanoElectrical Measurements in a Transmission Electron Microscope

**Abstract:** Nanocharacterization techniques are becoming increasingly important. They help us to determine local atomic arrangements, element compositions as well as electronic structures. High-Resolution Transmission Electron Microscopy (HRTEM) is the most powerful and widely accepted technique. However, until recently in-situ HRTEM did not show sufficient resolution to image changes on the atomic scale. In the last five years, my group has pioneered advanced specimen holders towards in-situ HRTEM. We have leading expertise in obtaining the high resolution in a range of controllable environments: temperatures, pressures, and liquids. In addition, combinations with other types of parallel measurements were pioneered, such as in-situ low-noise electrical characterization. Clearly it is indeed possible to operate the HRTEM as a nanolaboratory. It allows to really see what one is measuring. With this proposal I want to realize the equipment and methodology to perform nano-electrical measurements of nanostructures in-situ in a HRTEM. The NanoElectrical Measurements in a Transmission Electron Microscope (NEMinTEM) will be applied to nanostructures of a range of materials. Furthermore the electron beam will be used to make well-controlled modifications of the nanostructure. The effects of these modifications on the electrical properties will be measured simultaneously. Semiconductor nanowires, graphene, metallic bridges and nanoelectrodes, and oxide multilayers will be studied, providing challenging examples with possible high-impact results It is to be expected that once NEMinTEM is mature, it will be applied to many more materials.

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**NBR: 267991** **ACRONYM: SQUTEC** **EC FUND: 2308000**

**DG:** ERCEA **Call: ERC-2010-AdG_20100224** **Thema:** ERC-AG-PE3

**Title:** Solid State Quantum Technology and Metrology Using Spins

**Abstract:** The development of quantum devices by nanoscopic control of constituents is expected to be one of the largest and most intriguing challenges of modern solid state physics. Among the degrees of freedom which allow exploiting most quantum phenomena are

spins. Their long coherence and relaxation times make them of interest to any kind of quantum spin"tronics" from spin memories to quantum computing and ultrasensitive sensors. In well chosen and engineered environments spin state control and readout can be easy and robust even under ambient conditions. It is the aim of the present proposal to develop complex single spin systems from diamond defects and other dopant/host systems to a degree known hitherto only in atomic physics in terms of controllability and isolation from their environment. These systems should be used to investigate fundamental physical properties, e.g. the quantumness of solid state spins as well as their utilization in sensory devices. To this end spin defects should be implanted into ultrapure diamond materials with a spatial precision below 10nm. Their relaxation properties should be optimized to the ultimate (spin phonon interaction) limit and individual spin quantum states should be read out in a quantum non demolition-type measurement with highest possible fidelities. This on the one hand will allow the set up of versatile quantum arrays to e.g. study quantum many body physics. On the other hand such structures will yield sensors for magnetic and electric fields with unprecedented sensitivity and scale spatial resolution. Such devices might have revolutionary impact on imaging applications in various fields from materials' investigation to bio sciences.

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**NBR: 268004** **ACRONYM: BOTMED** **EC FUND: 2498043**

**DG:** ERCEA **Call: ERC-2010-AdG_20100224** **Thema:** ERC-AG-PE7

**Title:** Microrobotics and Nanomedicine

**Abstract:** The introduction of minimally invasive surgery in the 1980's created a paradigm shift in surgical procedures. Health care is now in a position to make a more dramatic leap by integrating newly developed wireless microrobotic technologies with nanomedicine to perform precisely targeted, localized endoluminal techniques. Devices capable of entering the human body through natural orifices or small incisions to deliver drugs, perform diagnostic procedures, and excise and repair tissue will be used. These new procedures will result in less trauma to the patient and faster recovery times, and will enable new therapies that have not yet been conceived. In order to realize this, many new technologies must be developed and synergistically integrated, and medical therapies for which the technology will prove successful must be aggressively pursued. This proposed project will result in the realization of animal trials in which wireless microrobotic devices will be used to investigate a variety of extremely delicate ophthalmic therapies. The therapies to be pursued include the delivery of tissue plasminogen activator (t-PA) to blocked retinal veins, the peeling of epiretinal membranes from the retina, and the development of diagnostic procedures based on mapping oxygen concentration at the vitreous-retina interface. With successful animal trials, a path to human trials and commercialization will follow. Clearly, many systems in the body have the potential to benefit from the endoluminal technologies that this

project considers, including the digestive system, the circulatory system, the urinary system, the central nervous system, the respiratory system, the female reproductive system and even the fetus. Microrobotic retinal therapies will greatly illuminate the potential that the integration of microrobotics and nanomedicine holds for society, and greatly accelerate this trend in Europe.

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**NBR: 268078** **ACRONYM: SINGLEION** **EC FUND: 1925673**

**DG:** ERCEA **Call: ERC-2010-AdG_20100224** **Thema:** ERC-AG-PE2

**Title:** Spectroscopy and microscopy of single ions in the solid state

**Abstract:** The progress in optical spectroscopy has made it is possible to study individual quantum emitters. However, only a few select “bright” emitters have been detected so far, leaving a large gap in the choice of critical parameters such as wavelength, coherence time, and energy level schemes. In this project, we develop methods for the detection of single emitters with long fluorescence lifetimes. In particular, we concentrate on rare earth ions embedded in crystals, which are of great technological and fundamental interest. To achieve this goal, we exploit methods from ultrahigh resolution microscopy, laser spectroscopy, scanning probe technology, cavity quantum electrodynamics, and plasmonics. The first approach to the detection of single ions at cryogenic temperatures will be to perform direct fluorescence excitation as well as absorption spectroscopy to address single Pr3+ ions spectrally within the inhomogeneous line of the sample. Here, we will develop a tunable laser system with sub-kHz linewidth for probing the narrow transitions of the ions. We expect a signal-to-noise ratio of about 10 in this first step. In order to improve this, we will enhance the emission of ions by pursuing two strategies. In the first case, we shall embed doped crystalline films in monolithic Bragg microcavities. In the second approach, we use plasmonic nanoantennas to reduce the radiative lifetime of the ions in the near field. The well-defined energy levels of ions provide ways for the preparation of long-lived coherent states for use in quantum information processing. Furthermore, access to the homogeneous spectra of ions at different temperatures and doping concentrations will shed light on fundamental open questions regarding their interaction with their matrices.

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**NBR: 268094** **ACRONYM: SCIFRI** **EC FUND: 2494000**

**DG:** ERCEA **Call: ERC-2010-AdG_20100224** **Thema:** ERC-AG-PE4

**Title:** Science Friction

**Abstract:** There is no fundamental law that dictates the necessity of losing energy in a sliding contact. In spite of its apparent simplicity, we have a relatively poor understanding of the mechanisms that determine how energy is lost when two bodies are forced to slide over one another. The SciFri project will launch a research attack on friction that will not only deepen our fundamental insight into this important phenomenon but also involves the development of several strategies to significantly lower or 'lose' friction under practical circumstances. " We will address in detail how energy is really dissipated on the atomic scale when sliding objects slip over a single lattice spacing. " We will bring friction to a halt by employing two mechanisms that we have explored recently on the atomic scale: superlubricity and thermolubricity. " Scaling up the two friction-lowering effects to the macro-scale will be attempted by a combination of two completely novel approaches. One is the use of special coatings, namely single monolayers of graphene or hexagonal boron nitride. The other involves a specific nanopatterning of the contacting surfaces. " In our friction experiments and modeling we will cover the full range of length scales, from the atomic regime all the way to the practical scale of so-called MEMS devices. This will prove to be an essential element in the extrapolation of nanoscale behavior to friction on a practical level. We will further compare measurements in uncompromised (ultrahigh) vacuum with observations under controlled ambient conditions, in order to explore the role of the atmosphere.

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**NBR: 268144** **ACRONYM: NANOSTRBIOSENS** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2010-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** NANOSTRUCTURED ALUMINA WAVEGUIDES FOR DUAL-OUTPUT BIOSENSING: STRESS INDUCED FABRICATION AND CHARACTERIZATION

**Abstract:** Most commercially available optical biosensors only measure changes in the refractive index of a solution very near the sensor surface. Information given by this approach is limited to the amount of analyte molecules linked into receptors on the sensor surface. In some cases, understanding complex bio-events is constrained when available data is based solely on refractive-index-change measurements via characteristics of the reflected light (intensity, polarization or phase). Scattering measurements need to be accompanied along with reflection measurements in order to determine the organization of molecules on a surface as well. This proposal calls for the development of nanostructured waveguides made of a thin layer of alumina (Al2O3) which would produce and control dual sensor outputs, specifically, total internal reflection (TIR) and surface enhanced Raman scattering (SERS) signals. Single-mode waveguides with structured surface will present a significant advantage over current optical biosensors by providing better information about both the binding and organization of protein molecules via polarization maintained reflection and scattering. After atomic layer deposition of single-mode waveguide alumina film, its surface modification will be done by a mechanics driven fabrication method called thermal stress induced hillock

formation. The main objective of this proposal is to fabricate and characterize a nanostructured alumina waveguide that will provide the following crucial advantages over the optical biosensor approach: 1) The possibility for dual-output with fine tuning, 2) a more complete understanding about the organization of molecules, 3) an unprecedented sensitivity for a label-free optical sensor, which will analyze information down to sub pmol/cm2 because of its enhanced electromagnetic (EM) field, and 4) the ability to control the molecular binding characteristics of the surface.

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**NBR: 268154** **ACRONYM: SOBONA** **EC FUND: 302100**

**DG:** REA **Call: FP7-PEOPLE-2010-IRSES** **Thema:** FP7-PEOPLE-2010-IRSES

**Title:** Solar Cells Based on Nanowire Arrays

**Abstract:** The area of photovoltaic devices is a very promising field for technological developments, with a very strong ecological and economic impact. The purpose of this exchange program is to create novel photovoltaic devices with record efficiencies using interdisciplinary expertise of the partners, and thereby to propose new concepts for solar cells. Joint experiments and training of researchers and PhD students will be carried out during the program. We plan to design and produce state-of-the-art prototypes of hybrid solar cells, which could include the best features from both thin-film and nanowire technologies. In particular, new promising routes for controlled engineering of CdTe/CdS junction interface in thin-film solar cells will be explored by growing CdTe nanowires at high temperature and under controlled ambient conditions. Other material interchanges will be performed using as platform recent advances in the growth of a wide range of III-V and II-VI nanowire arrays. To achieve the research goals of the project it is planned to carry out intensive exchange of research staff and PhD students. Five high rank international research groups will participate in the program, three of which are represented by the EU universities: • University of Durham, Department of Physics, Durham – UK (UDUR) • University Jaume I, Departament de Física, Castelló de la Plana - Spain (UJ-I) • University of Würzburg, Experimental Physics VI, Germany (UW) And the two third country groups are represented by the following Russian institutions: • Ioffe Physical-Technical Institute of the Russian Academy of Sciences (Ioffe PTI) • St. Petersburg Academic University of the Russian Academy of Sciences (SPb-AU) This project will allow the essential knowledge and material transfer between the partners, strengthening the collaborations and helping to establish a long-term research co-operation.

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**NBR: 268229** **ACRONYM: DAMASCO** **EC FUND: 45000**

**DG:** REA **Call: FP7-PEOPLE-2010-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Preparation and Application of new n-type, Electron Acceptor Materials in Organic Solar Cells

**Abstract:** Organic Photovoltaics have advantages compared to traditional inorganic solar cells, offering the prospect of low fabrication cost and flexiblility. The properties of organic and polymeric materials, open the perspective of a widely distributed photovoltaic low cost mass production. For this development to take place, the devices power conversion efficiency have to reach 10% and their lifetime have to increase. The development of polymer based solar cells has made significant progress but more research in the design and synthesis of new photoactive organic materials is needed. Bulk-heterojunction (BHJ) organic solar cells have active layers composed by electron-donating p-type semiconductors and electron-acceptor n-type materials. DAMASCO project will contribute to the design, synthesis and testing of new electron acceptor molecules and polymers with n-type properties for organic BHJ solar cells. Perylene diimides dyes are a significant class of n-type organic semiconductors for optoelectronics. These materials have good thermal and photochemical stability, high electron affinity, high absorption and their electronic properties can be easily modified via chemical tailoring by introducing substituent groups. Due to these properties, perylenes are candidates for organic photovoltaics. DAMASCO will develop novel perylene based molecules and polymers with n-type semiconduction properties and good solar harvesting. DAMASCO project has the following objectives: 1) design and synthesis of novel electron acceptor perylene based systems; 2) preparation and characterization of polymeric donor/acceptor photoactive blends; 3) assembling of BHJ solar cells and photovoltaic performance evaluation. The expected results are: a) new highly stable molecules and polymers with n-type semiconduction properties; b) nanostructured photoactive layer made of polythiophenes and perylene acceptor systems; c) BHJ solar cells with good harvesting of the solar light and longer live time.

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**NBR: 268236** **ACRONYM: ECL NANO-MATERIALS** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2010-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Development of nano-spheres and quantum dots for electrochemiluminescent (ECL) biomedical diagnostic sensor technologies

**Abstract:** This programme addresses how single molecules such as quantum dots or metal centres within nano-structured polyelectrolytes can be used to create efficient electrochemiluminescent (ECL) sensors multi-analyte detection, specifically for biomedical sensors with ultra-high sensitivities and selectivity's. The unique capabilities of these novel nano-materials will arise from the coupling of photonic, chemical, optical and fouling resistant properties of each component to create a sensitive and selective

detection system while allowing for applications in point of care devices. A combination of spectroscopic and electrochemical techniques will be utilised to elucidate the electron and/or energy transfer mechanisms, which will allow optimisation of device performance to be performed. The spectroscopic and electrochemical techniques highlight the redox reactions influencing the ECL production. Tailoring of surface properties and modification of polyelectrolytes will involve the use of several analytical techniques, including atomic force microscopy and electrochemical quartz crystal microbalance analysis. These studies focus on the binding of the polyelectrolyte, which will impart desirable surface chemistries at the material-solution interface to optimise the fouling resistant properties while retaining the sensitivity and selectivity of its ECL production for applications in imaging technologies. These materials will feed into product development which will incorporate sensor design, novel detection platforms and easy to use devices. The development of novel 2nd and 3rd generation materials will focus on the detection of cardiac Troponin I (TNI). The properties of these materials will uniquely enable the development of advanced diagnostic devices based on the luminescent detection of TNI at sufficiently low concentrations so as to change clinical practice.

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**NBR: 268271** **ACRONYM: NANODYGP** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2010-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Nanoscale Operation and Dynamics of small GTPases - Identification of novel Isoform specifying Determinants

**Abstract:** Small GTPases of the Ras superfamily, a major class of signalling proteins, control critical cellular functions, such as proliferation, differentiation, migration and trafficking. Their misregulation is associated with severe diseases, such as cancer or neurodegenerative diseases. More than 150 Ras-like GTPase are known, which are divided into four major subfamilies, each containing between 22 to 63 structurally related, but functionally distinct isoforms. A fundamental unresolved biological question in the field is the structure-based mechanism, which guides isoform specific functions. Recently, we provided new structural insight on how Ras operates in the context of the membrane. We showed that Ras adopts isoform specific orientations on the membrane, which in turn critically regulate Ras activity. These orientations are guided by a new switch III region and are stabilized by the amphipathic helix α4 and the membrane anchoring, C-terminal HyperVariable Region (HVR). Intriguingly, these structural elements vary from one isoform to another also in other subfamilies, suggesting that this mechanism is also operative in them. We will therefore study, whether this mechanism that involves helix α4 and the HVR also define isoforms of the Rho- and Rab-subfamily. In parallel, we will investigate the molecular mechanisms that are relevant for the overall membrane organisation of GTPases. This includes studies on the dynamics of the orientation, as well as on the mechanism of the formation of nanoscale assemblies (nanoclusters) of

GTPases on the membrane. We expect that our results have the potential to substantially transform the current understanding of GTPase functioning and answer a long-standing fundamental biological question. Moreover, both mechanisms represent new, specific targets for pharmacological interventions.

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**NBR: 268293** **ACRONYM: LASEM** **EC FUND: 45000**

**DG:** REA **Call: FP7-PEOPLE-2010-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Light assisted single electron manipulation

**Abstract:** The aim of this project is to develop new technique that allows single electron manipulation by the light. The novelty of the project is to take advantage of the unique capabilities of carbon nanotubes for single electron detection to study electronic properties of various types of molecular systems subjected to external light source. To do this a novel nanodevice layout consisting of the carbon nanotube (CNT) combined with quantum dots or molecules is proposed. In the device layout the CNT is acting as a ultra-sensitive detector for single electron detection and the quantum dot is attached to only one electrode – a nanotube. Two configurations of the device layout are proposed. In the first scenario the nanotube and the probed molecule are laying on an insulating oxide surface and in second scenario the device is suspended. This layout overcomes problem seen in standard devices where a molecular system is placed between two electrodes and very often it turns out that it is impossible to pass any measurable current through the system. Detection scheme is based on the fact that electrons can tunnel between the quantum dot and the tube detector. Electron transport between these nanoobjects will be controlled by light illumination and it will be detected by means of electron counting spectroscopy technique. The proposed idea represents a new strategy to study the separation in energy between the electronic discrete levels of the quantum systems subjected to the light illumination. Another aim of the project would be to investigate the effect of light on the transport properties of molecules that can undergo structural and electronic modification upon light exposure. Upon light exposure some molecules can undergo a process that results in change of the shape of the molecule. This will modify the molecule-tube tunnel barrier in the device. Light can also change the separation between energy levels of the molecule. Both cases can be monitored by proposed technique.

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**NBR: 268315** **ACRONYM: COLLODI** **EC FUND: 45000**

**DG:** REA **Call: FP7-PEOPLE-2010-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Colloidal aspects of lipid digestion: the physics behind healthier food

**Abstract:** An emerging application of colloidal science, due to the growing social and economic consequences of the obesity crisis in the developed world, is the design of healthier foods to control fat uptake in the diet. Consequently molecular mechanisms of digestion and metabolism of lipids are generating renewed scientific interest. Lipase-colipase complexes adsorb onto the surface of lipid droplets to access and hydrolyse fats into a form absorbed by the body (lipolysis). Studies I made on the recent Marie-Curie action (LIPOGEST) suggest that processed food emulsions could be designed to slow rates of lipolysis, inducing satiety, and lowering fat intake in the diet. Use of nanoscience methods to visualise bile salt adsorption under in vitro duodenum conditions suggest that interfacial structures of protein-stabilised emulsions could be designed rationally to control bile salt adsorption, reducing lipase-colipase adsorption and rates of lipolysis. An important aspect of such design is ensuring that modified interfaces survive digestion conditions in the stomach. LIPOGEST enabled me to investigate the effect of stomach conditions on interfacial structures for the first time, identifying new facets of these processes, such as an unexpected synergism between surfactants and proteolytic enzymes in the proteolysis of interfacial layers. Such knowledge offers routes to control proteolysis enabling successful design of emulsions to control fat intake. In the present proposal I intend to consolidate and expand these findings into how the process of digestion affects the structure and stability of model emulsions and interfacial layers. This information will be obtained by using state-of-the-art colloidal characterisation techniques and theoretical models. Through this approach I aim to understand the role of food structure on lipid digestion and metabolism. The improved understanding of this process could enable the design of food emulsions with specific lipid digestion profiles.

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**NBR: 268347** **ACRONYM: ATTOCALMAT** **EC FUND: 45000**

**DG:** REA **Call: FP7-PEOPLE-2010-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Atto-calorimetric tools to explore material properties in the nanoscale

**Abstract:** Nanoscale phenomena where the surface/interfaces or the small dimensions play a predominant role in the physical properties have become increasingly important in the last decade. Many characterization techniques have been adapted to face new challenges and understand new phenomena and calorimetry is no exception. ATTOCALMAT project pursues the development of a new nanocalorimetric technique the 'microsecond-pulsed steady-state method' that will combine the signal enhancing of the fast scanning and the advanced signal averaging of steady-state techniques. Preliminary results with sensitivities of 5 pJ/Kmm have already shown an improvement by a factor of 50 compared to the best steady state techniques. With the scaling down of the Si-nanochips (sensing areas~200 nm^2), the addenda reduces to few fJ/K. The increase of surface selectivity is followed by the sensitivity with values of 0.2 aJ/K. Chips

with a monocristalline Si layer below the SiNx membrane will easy the study of epitaxial materials. With the new cutting edge technique and the nanochip measurement of heat capacities of single nano-objects as function of temperature but also of external variables (like magnetic and electrical field, time…) are within reach. This thermal tool will be applied to underpinning the physical properties of materials that represent a leading edge research frontier in nanoscale science towards its end-use in potential applications as magnetic storage, spintronics or photonics. Several of the challenging and unexplored measurements proposed are: (i) Magnetocalorimetry to detect Néel's wall formation in the antiferromagnetic material of an exchange biased system on physical properties. (Co/CoO or Ni/NiO) (ii) Measurements of energy involved on the 2D-3D transition of Ge epitaxial heteroestructure on Si. (iii) Nanocalorimetric study of low dimensionality effects in the ferromagnetic transition of epitaxial EuO on Si.

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**NBR: 268357** **ACRONYM: LSV-SIE** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2010-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** The role of surface scattering and impurities in metallic lateral Spin-valve Devices

**Abstract:** The field of spintronics is receiving continuous and growing attention, due to the expected increase in functions of lateral spintronics devices to include promising elements such as nonvolatile spin field effect transistors, ultra-fast memories and spin-based quantum computers. But, in order to utilize such lateral applications in industrial settings, a critical improvement in their performance is necessary, for which much basic research is still required. An important issue, which is relevant to the nano-scale lateral devices and has not received much attention, is surface effects. Here, spin scattering from the surface can lead to loss of all spin signals. The study and understanding of spin scattering, due to surface effects is one of the major goals of the proposed research. The study of lateral spintronics devices has led to discovery of many new phenomena; include spin transfer torque; crossed Andreev reflections and the spin Hall Effect. In the latter, anisotropic spin dependent scattering in non-magnetic materials induce a transverse spin current. This enables the generation of spin polarized currents in non-magnetic material without the need of injection from a ferromagnet. But, a larger magnitude of the effect is vital if one considers this a realistic source of spin-polarized current for application. We aim at increasing the spin Hall effect in metallic spintronics devices by resolving quantitatively the geometrical and material related contributions of the effect. Study of these spin transport phenomena via local probe measurements is a very powerful approach, as has been demonstrated for semiconductors using optical methods. We intend to develop and measure the local spin accumulation by an MFM-based measurement with an anticipated ~10 nm spatial resolution. This is x100 better than previous measurements, and will enable us to spatially resolve the local spin accumulation in metallic devices.

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**NBR: 268370** **ACRONYM: REALTIMEIMAGING** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2010-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Real Time Imaging with Near Field Focusing Plates

**Abstract:** This project describes the four years re-integration program to facilitate a successful and continuous integration of Dr. Ozdal Boyraz's research in the real time optical detection and imaging field into the EU's needs, and to support Dr. Ozdal Boyraz's re-integration to research and educational activities at the Istanbul Sehir University and in EU. Spectroscopy and imaging of biological samples with ultra high resolution are subjects of growing interest. With the advent of nanotechnology, metamaterials, and plasmonic devices the sub wavelength resolution is now a concrete possibility in microscopy. However, the current state of the art imaging tools resort to time averaged analysis to extract high resolution information from a single point at the expense of loosing information on transients and correlated events in the proximity of the focal spot. The proposed research aims to develop a real time system using time-space-wavelength encoded mesh type optical grids to capture the image in a 2-D plane in a single shot. Instead of resorting to imaging with point by point scanning via nano positioning stages, broadband coherent optical sources covering the area of interest are used to capture information from a multiple coordinates by encoding them on a designated color and a time slot to avoid scanning. The design and development of near-field focusing plates is incorporated into the project for subwavelength focusing to mitigate the resolution bottleneck and achieve sub wavelength microscopy in a single shot measurement. Space wavelength mapping has been utilized extensively for arbitrary waveform generation and microwave antenna design. The impact of this technology in bio detection and imaging is yet to be explored in subwavelength domain. Design and fabrications are compatible with conventional CMOS technology and attractive for low cost production.

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**NBR: 268386** **ACRONYM: ULEVIS** **EC FUND: 75000**

**DG:** REA **Call: FP7-PEOPLE-2010-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Ultra Low Energy Vertically Integrated Circuits

**Abstract:** The current integrated circuit scaling hits two major roadblocks or walls. One wall is the atomic level feature sizes of the current devices forcing the capabilities of even nano-scale implementations. The other wall is the total power consumed per unit area exceeding the capabilities thermal dissipation techniques limiting the maximum device densities. The solution to the feature size problem is scaling in the orthogonal direction

to the conventional device plane - the 3D integration. The solution to the power problem is the use of ultra low power design approaches. However, the 3D integration increases the thermal dissipation problem and ultra low power design can not provide total performance due to low clock speeds unless extremely large number of devices is combined in small areas. We propose a unique combination of ultra low power design approaches and 3D integration to provide an optimal performance to the user. Low power design eliminates the thermal dissipation problem of the 3D integration whereas 3D integration enables dense device integration in small volumes to solve the space-time trade-off in ultra low power design approaches. The result will be a vertically integrated circuit with power efficiencies several hundred times better than current dedicated processors.

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**NBR: 268387** **ACRONYM: PHOENICS** **EC FUND: 45000**

**DG:** REA **Call: FP7-PEOPLE-2010-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Photocatalytic and Energy â€“ storage Innovative Concretes

**Abstract:** The proposed project aims to develop the next generation of high-tech, environment-responsive concretes, based on nanotechnology, that will: • depollute the air by means of oxidation of (common) inorganic pollutants, such as nitrogen oxides (NOx); • improve building aesthetic durability through enhanced self-cleaning properties of building facades; • increase the energy storage capabilities of new and renovated buildings (heat capacity of this new materials is increased with a factor 30-40 compared to traditional concrete) by limiting the day versus night temperature variations, leading to lower energy consumptions for heating and cooling and as a direct result, reduced CO2 emissions. These aims will be achieved through the development and integration of either specific photocatalytic systems, with enhanced activity in the visible light portion of the solar spectrum, or novel crystal engineered photocatalysts into concrete. The energy conservation capability of these innovative construction materials will be developed for new and renovated buildings by incorporating novel, high latent heat per unit volume, nanotech phase change materials (PCMs) capable of energy storage. The project involves DTI (Danish Technological Institute, host institution, Denmark), University of Aberdeen (Scotland, UK) and Huntsman Pigments (England, UK). The project is designed for a period of 3 years. The first year is centred on the study and development of suitable visible light photocatalysts and novel phase change materials, then the materials will be optimised for their integration into concrete as well as scaling up the laboratory tests for performance assessment in real-world conditions, in new or renovated buildings.

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**NBR: 268476** **ACRONYM: BIOSILICA** **EC FUND: 2183600**

**DG:** ERCEA **Call: ERC-2010-AdG_20100317** **Thema:** ERC-AG-LS9

**Title:** From gene to biomineral: Biosynthesis and application of sponge biosilica

**Abstract:** During the last decade, the principles of biomineralization have increasingly attracted multidisciplinary scientific attention, not only because they touch the interface between the organic/inorganic world but also because they offer fascinating bioinspired solutions to notorious problems in the fields of biotechnology and medicine. However, only one group of animals has the necessary genetic/enzymatic toolkit to control biomineralization: siliceous sponges (Porifera). Based on his pioneering discoveries in poriferan molecular biology and physiological chemistry, the PI has brought biosilicification into the focus of basic and applied research. Through multiple trendsetting approaches the molecular key components for the enzymatic synthesis of polymorphic siliceous skeletal elements in sponges have been elucidated and characterized. Subsequently, they have been employed to synthesize innovative composite materials in vitro. Nonetheless, knowledge of the functional mechanisms involved remains sketchy and harnessing biosilicification, beyond the in vitro synthesis of amorphous nanocomposites, is still impossible. Using a unique blend of cutting-edge techniques in molecular/structural biology, biochemistry, bioengineering, and material sciences, the PI approaches for the first time a comprehensive analysis of natural biomineralization, from gene to biomineral to hierarchically ordered structures of increasing complexity. The groundbreaking discoveries expected will be of extreme importance for understanding poriferan biosilicification. Concurrently, they will contribute to the development of innovative nano-biotechnological and -medical approaches that aim to elicit novel (biogenous) optical waveguide fibers and self-repairing inorganic-organic bone substitution materials.

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**NBR: 268498** **ACRONYM: STCSCMBS** **EC FUND: 132200**

**DG:** REA **Call: FP7-PEOPLE-2010-IRSES** **Thema:** FP7-PEOPLE-2010-IRSES

**Title:** Statistical Thermodynamics and Computer Simulations of Complex Molecules in Bulk and at Surfaces

**Abstract:** The aim of the project is to perform advanced theoretical and computer simulation studies of nonuniform fluids involving complex molecules. It comprises of three work packages: (i) fluids in contact with tethered layers formed on surfaces and in pores, (ii) substrate driven self-assembly of supramolecular structures formed by complex organic molecules, and (iii) substrate induced self-assembly of nanoparticles with chemical dichotomy. The first work package will involve research of thermodynamic properties and microscopic structures of fluids in contact with a single surface and in pores with walls modified by tethered brushes. We intend to study how these properties depend

on the molecular parameters of the model, as well as on thermodynamic variables. We plan to perform studies at different levels of modeling of tethered brushes, from molecular to coarse-grained models, and apply different theoretical tools (density functional theory, molecular dynamics and dissipative particle dynamics simulations). The goal of the second work package will be to study the surface-induced self-assembling of Liquid crystalline dendrimers (LCDr) into bulk as well as surface phases.We will develop a range of surface potentials and study the surface driven self-assembly into monolayer and thin films. Then, we shall investigate the surface induced assembly of liquid crystalline dendrimers into bulk phases in wide slit pores and in the cases of the surface anchoring frustration. The third work package involves studies of behavior of Janus particles in the bulk and at surfaces. In particular, we plan to determine the structure and phase behavior of self-assembled phases of simple dichotomic (Janus) molecules. Then, we shall investigate transport phenomena in self-assembled fluid nanostructures formed by dichotomic molecules and attempt to develop realistic models of self-assembled phases formed by complex organic fluids.

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**NBR: 268523** **ACRONYM: CASINO** **EC FUND: 2399127**

**DG:** ERCEA **Call: ERC-2010-AdG_20100317** **Thema:** ERC-AG-LS3

**Title:** Carbohydrate signals controlling nodulation

**Abstract:** Mechanisms governing interaction between multicellular organisms and microbes are central for understanding pathogenesis, symbiosis and the function of ecosystems. We propose to address these mechanisms by pioneering an interdisciplinary approach for understanding cellular signalling, response processes and organ development. The challenge is to determine factors synchronising three processes, organogenesis, infection thread formation and bacterial infection, running in parallel to build a root nodule hosting symbiotic bacteria. We aim to exploit the unique possibilities for analysing endocytosis of bacteria in model legumes and to develop genomic, genetic and biological chemistry tools to break new ground in our understanding of carbohydrates in plant development and plant-microbe interaction. Surface exposed rhizobial polysaccharides play a crucial but poorly understood role in infection thread formation and rhizobial invasion resulting in endocytosis. We will undertake an integrated functional characterisation of receptor-ligand mechanisms mediating recognition of secreted polysaccharides and subsequent signal amplification. So far progress in this field has been limited by the complex nature of carbohydrate polymers, lack of a suitable experimental model system where both partners in an interaction could be manipulated and lack of corresponding methods for carbohydrate synthesis, analysis and interaction studies. In this context our legume model system and the discovery that the legume Nod-factor receptors recognise bacterial lipochitin-oligosaccharide signals at their LysM domains provides a new opportunity. Combined

with advanced bioorganic chemistry and nanobioscience approaches this proposal will engage the above mentioned limitations.

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**NBR: 268537** **ACRONYM: THINK** **EC FUND: 2500000**

**DG:** ERCEA **Call: ERC-2010-AdG_20100317** **Thema:** ERC-AG-LS6

**Title:** The Immune function of NK cells

**Abstract:** In this project, we propose to explore a new area in biological research aiming at dissecting emerging of properties of the innate immune responses. Our system model is the Natural Killer (NK) cell. Specifically, we will investigate the mechanisms by which these players of innate immunity achieve tolerance to self and participate to immune responses. Multidisciplinary approaches will be combined to achieve groundbreaking results at nanoscopic and macroscopic scales on the following issues: - How NK cells are educated to self-tolerance? - How NK cells distinguish their targets from normal cells? - How NK cells participate to immunological memory? THINK (THe Immune function of Natural Killer cells) is a challenging project supported by an array of preliminary data obtained by our team of investigators in various fields of expertise: - innate immunity and NK cells in human and mouse models - random insertional mutagenesis in the mouse - genome-wide epigenetic, transcriptomic and RNAi analysis and - state-of-the-art optical imaging techniques from intravital biphoton microscopy to the quantification of proteins in nano-sized areas of the cell. THINK is thus a multidisciplinary project that bridges disciplines: immunology, biophysics, genetics and epigenetics. In a scientific perspective, we think that this project will open new technological and scholar horizons, in reassessing the actual concepts on the links between innate immunity, tissue homeostasis and stress response. In a clinical and translational perspective, we also think that this project will help to design innovative NK cell-based therapies and immunomonitoring protocols.

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**NBR: 268548** **ACRONYM: NANOPHYS** **EC FUND: 2500000**

**DG:** ERCEA **Call: ERC-2010-AdG_20100317** **Thema:** ERC-AG-LS5

**Title:** Nanophysiology of fast-spiking, parvalbumin-expressing GABAergic interneurons

**Abstract:** In the present proposal, we plan to examine the dendrites, axons, and presynaptic terminals of fast-spiking, parvalbumin-expressing GABAergic interneurons using subcellular patch-clamp methods pioneered by the PI, imaging techniques, and computational approaches. The goal is to obtain a quantitative nanophysiological picture of signaling in this key type of interneuron. By incorporating realistic BC models

into dentate gyrus network models, we will be able to test the contribution of this important type of GABAergic interneuron to complex functions of the dentate gyrus, such as pattern separation, temporal deconvolution, and conversion from grid to place codes. The results may lay the basis for the development of new therapeutic strategies for treatment of diseases of the nervous system, targeting interneurons at subcellularly defined locations.

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**NBR: 268788** **ACRONYM: SMI-DDR** **EC FUND: 2366576**

**DG:** ERCEA **Call: ERC-2010-AdG_20100317** **Thema:** ERC-AG-LS3

**Title:** Single Molecule Imaging of the DNA Damage Response in Live Cells

**Abstract:** Accurate DNA replication is key to maintaining genomic stability. Replication is immensely complex requiring error-free duplication of several billion bases each time a human cell divides. The DNA replication machinery must deal with a wide range of DNA damage, aberrant secondary structures and DNA:protein complexes; obstacles that cause replication forks to arrest. Arrested replication complexes are actively stabilised by checkpoint pathways, but in some cases component proteins still dissociate from the site of DNA incorporation, resulting in fork ¿collapse¿. Collapsed forks can be restarted by homologous recombination (HR)-based processes, but are strongly associated with gross chromosomal rearrangements. Thus, the advantage gained by restarting a collapsed fork comes at the expense of an increased potential for genome instability. Structural, biochemical, and molecular techniques identified the main components and regulators of these processes, but are inherently limited to studying the system in bulk, thereby averaging events and limiting our understanding of the dynamics and behaviour of molecular participants. To overcome these limitations and to study single molecules at a single arrested or collapsed fork I propose to develop an nTIRF-PALM ¿super-resolution¿ microscopy platform that will allow the identification of individual protein molecule as well as very small numbers of molecules at

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**NBR: 268906** **ACRONYM: SOUND PHARMA** **EC FUND: 2500000**

**DG:** ERCEA **Call: ERC-2010-AdG_20100317** **Thema:** ERC-AG-LS7

**Title:** Image Guided Local Drug Delivery from Nanocarriers v

**Abstract:** The principal objective of the Sound Pharma project is to increase the therapeutic index of potent, often toxic treatments through personalized image-guided treatment, which ultimately decreases adverse effects of drugs by better controlling the pharmacokinetics (PK) and pharmacodynamics (PD) of therapy. For local disease, exogenous energy will be

used to to release drugs entrapped within nanoparticles circulating through the tumor. This will be achieved via a combination of Focused Ultrasound, and drug nanocarriers that are sensitive to bio-effects of ultrasound. The drug ¿magic bullet¿ is at the heart of Pharma¿s business model. However, targeted drug delivery is increasingly being recognized as a key limiting factor of drug efficacy. Nanotechnologies are providing new formulations as well as novel methods for targeting. The combination of nanotechnologies and external triggering will provide novel technologies to achieve spatio-temporal control of drug delivery. The effect of ultrasound in tissue allows the local deposition of drugs from nanocarriers circulating in the blood, and/or their local activation. This is the case when using nanocarriers sensitive to mechanical forces and/or to small temperature elevations. Extravasation and membrane permeability are also enhanced by ultrasound. This new field of Image Guided Drug Delivery opens up opportunities for Pharma to expand applications for their existing small drugs (e.g. doxorubicin, cisplatin, irinitecan) in cancer by altered pharmacokinetics. This project intends to develop new focused ultrasound methods for drug delivery, based on local control of temperature and pressure, and by monitoring and validating intracellular uptake in real time using optical and MRI methods. The developed FUS methods will be applied to treatment of liver cancer using nanocarriers containing well known chemotherapeutica, via animal models, as well as in the clinic.

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**NBR: 269019** **ACRONYM: PATHFINDER** **EC FUND: 2498680**

**DG:** ERCEA **Call: ERC-2010-AdG_20100317** **Thema:** ERC-AG-LS7

**Title:** Mimicking pathogens

**Abstract:** Tumour cells survive and grow because they are not effectively recognized by the immune system as ¿foreign¿ and are therefore not attacked and destroyed like most pathogens. We have already demonstrated the clinical value of dendritic cell (DC) vaccines that activate the immune system to fight cancer. Treating more than 300 patients with metastatic melanoma, we achieved extended survival in 40% of patients by maturing dendritic cells from the patient¿s blood in-vitro, loading them with cancer-specific antigens and re-injecting them into the patient. These DCs then activate tumour-specific T cells in the lymph nodes. Our success in this area of research makes us a world leader in dendritic cell immunotherapy. However, despite these encouraging results, more work needs to be done if this type of therapy is to move into routine cancer care. Therefore the primary objective of the research detailed in this proposal is to significantly enhance cancer treatment efficacy by developing multifunctional nano-sized vaccine carriers that specifically target DCs and T cells in-vivo. If successful, this will also eliminate the costly in-vitro steps associated with current dendritic cell therapy. The recent discovery of pathogen recognition receptors on dendritic cells opens up the possibility of exploiting these receptors to target dendritic cells within the body. We will therefore develop highly functionalized, slow-release vaccine carriers that target DCs in

this way. In order to directly activate tumour-specific T cells, we will develop highly flexible polyisocyanide polymers that mimic naturally occurring DCs. To functionalize these polymers, we aim to develop a revolutionary DNA-based bar-coding technique. I expect this new approach leads to major advances in tumour immunotherapy.

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**NBR: 269051** **ACRONYM: QUIDPROQUO** **EC FUND: 2979700**

**DG:** ERCEA **Call: ERC-2010-AdG_20100317** **Thema:** ERC-AG-ID1

**Title:** Molecular Nanotechnology for Life Science Applications: QUantitative Interactomics for Diagnostics, PROteomics and QUantitative Oncology

**Abstract:** The main goal of this proposal is to introduce innovative devices and protocols (based on nano- topography, the response of micro-(nano-)mechanical oscillators and nano-fluidics) to carry out, precise, high throughput, high sensitivity, and low cost interactomic measurements. We aim at measuring, in parallel, the concentration of up to hundreds of proteins, in samples down to the single cell level, following the real time concentrations of several biomarkers in patient's serum down to femto-molar concentrations. We plan to develop our program a) by applying the principles and practice of intrinsically differential measurements, e.g. by building a nano-fluidic equivalent of the Wheatstone Bridge, a standard tool for differential high sensitivity electrical resistance measurements and b) by using the vertical equivalent of cantilever oscillators (pillars) that we plan to use as quartz "microbalances" that are 10,000 time more sensitive than cantilevers w. r. t. measurable min. mass and 100 time more sensitive w. r. t. dilution. The proposal's core strategy is to exploit the PI's expertise in innovative instrumentation and his integrated physical chemistry know-how, leading a highly multi-disciplinary staff to closely interact with first class medical staff in hospital settings to solve, and validate the solution of, relevant medical problems. For instance, the sensitivity of our sensors will allow protein analysis from very small and homogeneous samples of tumor cells and the monitoring of very dilute concentrations of autoimmune response to antibody treatment allowing, in addition to improved cancer diagnostics, also the prediction of patient response to treatment. The convergence between chemistry and biology, through nanotechnology, with medical diagnostics would enable our team to come up with more versatile and reliable diagnostic tools while stimulating fundamental research in fields as diverse as stem cells differentiation and the study of cell physiopathology.

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**NBR: 269099** **ACRONYM: PHOTORELEASE** **EC FUND: 186200**

**DG:** REA **Call: FP7-PEOPLE-2010-IRSES** **Thema:** FP7-PEOPLE-2010-IRSES

**Title:** Fabrication of particles with photo receptors: bio-analytical application such as controlled drug delivery

**Abstract:** The importance of carbon-based materials in biological applications has been recognized. Especially, nanodiamond particles (referred to as nanodiamonds, NDs) have started to emerge as novel candidate for promising applications in the field of nano-biotechnology as imaging probes and drug carriers. NDs do not show the toxicity of other nanoparticles, notably gold, making them ideal nanoscale drug delivery platforms. Furthermore, NDs can exhibit intrinsic fluorescence from point defects making them candidates for biomedical imaging applications. ND particles are particularly attractive for biomedical applications as functionalization and biomolecule immobilization are readily accomplished. Triggered drug release allows the functionalized NDs to find their targets before the drugs are activated by local conditions. In this sense, the NDs are performing the well established role of postdrugs, smuggeling the inactive compound to their targets where they are released through bond cleavage. The objective of the proposed program concerns the fabrication of NDs modified with photo-label linkers where different molecules can be directly attached, without chemically modification of the biomolecule itself. In a proof of principle, horse radish peroxidase (HRP) will be linked to NDs modified with the photo-label o-nitrobenzyl group and the release followed by UV/Vis. In a later state the controlled release of drugs such as ibuprofen, adriamycin or antigens will be looked at. The proposed research project brings together centers from France, the UK, Spain and the Ukrain. The network offers training in the fabrication and characterization of new materials for biological applications.

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**NBR: 269113** **ACRONYM: M6** **EC FUND: 529200**

**DG:** REA **Call: FP7-PEOPLE-2010-IRSES** **Thema:** FP7-PEOPLE-2010-IRSES

**Title:** Micro- Multi-Material Manufacture to Enable Multifunctional Miniaturised Devices

**Abstract:** For some decades the world has been able to see the ultimate impact of device miniaturisation which has led to dramatic growth in national and global revenues alongside the huge benefits that have been brought to human activities, in the healthcare/medical, energy, space, transport, communication and defence sectors. Evolving initially from silicon based manufacturing technologies thanks to the huge investment and established infrastructure, current state-of-the-art play in moving further according to the “More than Moore” has substantially extended the global capacity in achieving complex microsystem integration using hybrid processes, multi-materials that are significantly confined in an ever small space or dimensions. The challenges in the endeavour of continuous miniaturisation therefore exist in the fundamental understanding of the phonemes behind all the play, in order to underpin a paradigm of future generation miniaturised device. With significant developments for some decades the various capabilities and expertise bridging the EU and Asia are now

available to readily forge a tangible strong consortium targeting such an important field. Given its inter-disciplinary nature, the project will cover a wide breadth of research topics as demanded through collaborations and researchers' mobility provided by International Research Staff Exchange Scheme as one of the Marie Curie Actions to draw the strength from the representative institutions in Germany, Japan, China and UK. The project will focus on the potential challenges and potential issues encountered in the integration of miniaturised devices in terms of novel materials and processes, characterisation and testing, demonstrating the manufacturability and reliability. Both experimental and computational approaches will be applied to elaborate the fundamental aspects of multi-material behaviour at micro- and nano-scales.

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**NBR: 269128** **ACRONYM: ENVIRONBOS** **EC FUND: 119700**

**DG:** REA **Call: FP7-PEOPLE-2010-IRSES** **Thema:** FP7-PEOPLE-2010-IRSES

**Title:** Isolation, Characterization and screening of environmental applications of Bio-Organic substances obtained from urban biomasses (EnvironBOS)

**Abstract:** The organic fraction of urban wastes can represent a rich source of bio-organic substances (BOS) easily available from urban facilities performing aerobic or anaerobic biodegradation of biomass residues; they may provide a large variety of BOS fitting a wide range of uses. The aim of the project is to explore the valorization of these residues by their use in the detoxification of other aqueous wastes. In particular, three research lines are of our interest: 1- Determination of the photophysical and photochemical properties of BOS and main reactive species that are able to generate. 2- Use of BOS as solar photocatalysts, possible participation in the self cleaning of the effluents and other related strategies for waste minimization. 3- Use as templates for the synthesis of materials for environmental purposes, such as mesoporous titanium dioxide or nanoparticles of Ag, Si or Au. Four multidisciplinary groups from Argentina (Laboratorio de Especies Altamente Reactivas, from Universidad Nacional La Plata), with research lines focused on environmental chemistry and materials science, Brazil (Instituto de Química; Universidade de Sao Paulo) with research interests in laboratory and pilot waste treatment and development of industrial simulation procedures, Italy (University of Torino) with research interests in photochemistry, environmental and analytical chemistry as well as material science and Spain (Grupo Procesos de Oxidación Avanzada, Universidad Politécnica de Valencia), that investigates in solar photocatalysis, photophysics and textile engineering, will collaborate to carry out this group. A training program focused on early researchers and a diffusion program for the obtained results will also be implemented. With this background a exchange program to benefit the synergies between the groups is planed, as explained in detail at section B.

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**NBR: 269140** **ACRONYM: NANOCOM** **EC FUND: 161500**

**DG:** REA **Call: FP7-PEOPLE-2010-IRSES** **Thema:** FP7-PEOPLE-2010-IRSES

**Title:** Nanostructured composite materials

**Abstract:** In the search for new materials with enhanced functionality, glassy nanocomposites comprising of nanoparticles of different nature in glassy matrix are of special interest. In the case of metal nanoparticles this is because the pronounced surface plasmon resonance, which dominates the optical properties of glass-metal nanocomposites (GMN) and provides high optical nonlinearity of GMN due to additional enhancement of the electric filed in the vicinity of the nanoparticles. This resonance can be coupled to other resonances of different nature, like Bragg-type resonance mode in periodic medium or resonant electronic transition in glass doped with ions of rare-earth or transition metals. The strong coupling of surface plasmon to other resonant modes differing in origin can dramatically enrich the optical properties of GMN enabling photonics materials with strong and fast optical nonlinearity and spectral tunability. Modification of metal nanoparticles with, e.g., femtosecond laser irradiation can modify spectral properties and even change the temporal dynamics of the plasmon mode and such manner enrich functionality of the GMN. In the framework of the NANOCOM we will develop innovative approach to development of novel materials based on nanostructuring glassy composites and will create such materials. The research objectives of the NANOCOM are modeling, manufacturing and investigation of (i) sub-micron patterned nanocomposites, (ii) GMN comprising of bimetallic nanoparticles, and (iii) GMN modified with femtosecond laser pulses. We anticipate that theoretical and experimental results of NANOCOM will provide new insights in the mechanisms of the linear and nonlinear response of nanocomposites on electromagnetic fields. New functionalities arising from the coupling of resonant excitations of different ori-gin and to the modification of GMN response by fs laser processing will enable development of advanced glassy materials for photonic and electronic applications.

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**NBR: 269153** **ACRONYM: CHILTURPOL2** **EC FUND: 197400**

**DG:** REA **Call: FP7-PEOPLE-2010-IRSES** **Thema:** FP7-PEOPLE-2010-IRSES

**Title:** Innovative materials and methods for water treatment

**Abstract:** WHO reports annular death of 5 million people caused by the use of contaminated water. To reduce this number more effective purification technologies and grow of ecological consciousness should be introduced. Both of them are considered in the project by the following objectives: to bring together some international research teams, - to focus their invention on a search for new materials to be used in water

treatment, - to merge the students curricula, - to open the double supervising issue. The exchange supports some collaboration programs among the European partners (TUBITAK, MEDRC, NATO projects) and refreshes it with new Chilean input. The project makes more strengthen ties between two European and one of leading Chilean universities that is initiated by common project of the Chilean National Commission for Scientific and Technological Research. Two European institutions are participating: -Wroclaw University of Technology, Faculty of Chemistry, Poland, -Ege University, Faculty of Engineering, Turkey, and one Chilean university: -Concepcion University, Center for Research on Advanced Polymers. The project is scheduled for 3 years and envisages exchange of 8 researchers form Europe and 3 from Conception University. Researchers of each partner university will participate in 2 workshops together with participants of a hosting institution. The main point of the exchange program is to expand an overseas collaboration and to deliver the most relevant state-of-the-art on nanostructured materials and innovative technologies for water purification. The long term goals of the research are as follows: -to develop scientific relationship between Europe and Chile related to water treatment, -to promote new market for innovative materials and technologies, -to modify teaching programs and put them in line with scientific, industrial and social challenges.

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**NBR: 269159** **ACRONYM: BIOMIMEM** **EC FUND: 214200**

**DG:** REA **Call: FP7-PEOPLE-2010-IRSES** **Thema:** FP7-PEOPLE-2010-IRSES

**Title:** Biomimetic Membrane Systems

**Abstract:** Biological membranes play a central role in the living organization, but it is difficult to study protein-protein and protein-membrane interaction under controlled conditions inside of the living cells. Pioneering works have been carried out, indicating that biomimetic membrane systems such as lipid monolayers, liposomes, solid-supported or polymer-cushioned lipid membranes, can not only serve as biophysical models to study protein-protein and protein-membrane interactions, but also can be used to the design of biosensors and drug carriers. We feel it is extremely timely to form a partnership that combines researchers who have significantly contributed to this topic with the hope that our combined effort will lead a further and deeper understanding of the structure and functions of biological membranes. The IRSES project BIOMIMEM aims at connecting groups in the Germany (MPIKG), France (Lyon) and China (ICCAS and Harbin) which are working on biomimetic membrane systems. The exchange programme is organized into definite but complimentary 4 work-packages (WPs) that are executed by the combined effort of the above-mentioned 4 partners. This project brings together leading researchers with broad, complementary expertise: from biophysical chemistry, biochemistry, theoretical chemistry, to the more applicable aspects of nanobiotechnology, to form a team with the common goal of understanding the fundamental nature of biological membranes and developing new biosensors and drug

carriers. Moreover, it will support and reinforce collaboration among the participants, help to educate young researchers, and help to develop and establish future long-term research collaboration between EU and China.

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**NBR: 269169** **ACRONYM: FUNPROB** **EC FUND: 374300**

**DG:** REA **Call: FP7-PEOPLE-2010-IRSES** **Thema:** FP7-PEOPLE-2010-IRSES

**Title:** Functional semiconductor nanowire probes

**Abstract:** Scanning probe microscopy (SPM) is an established technique for the characterisation of materials and structures at the nanoscale and is increasingly bridging traditional disciplines including the biosciences. As such, it is of fundamental and practical interest across the sciences and industry. The geometry of the tip is the critical factor which determines the resolution of an SPM sensor. In an attempt to achieve ultra high spatial resolution, carbon nanotubes have been widely investigated and shown some promise. However, it is extremely difficult to control the properties of these tubes, especially the electrical behaviour and growth geometry. Equally, their manipulation is a daunting task. We propose to use III-V semiconductor nanowires as functioning sensors at the apex of scanning probes. These structures can be directly grown on the substrates or SPM cantilevers with controllable properties at the nanometre scale. Using these nanowires offers excellent new avenues for the integration of established semiconducting devices onto the tip of a scanning probe. This will improve the sensitivity and functionality of scanning probe methods. An example of potential applications for such a novel probe is the detection of virus based on their electrical response which can be coupled to that of nanowires under appropriate conditions. Within the framework of this project, we will combine the complementary expertise of various internationally leading institutions for the creation of integrated individual semiconductor nanowire SPM probes exhibiting enhanced functionalities.

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**NBR: 269182** **ACRONYM: META** **EC FUND: 403200**

**DG:** REA **Call: FP7-PEOPLE-2010-IRSES** **Thema:** FP7-PEOPLE-2010-IRSES

**Title:** Materials Enhancement for Technological Applications

**Abstract:** META (Materials Enhancement for Tecnological Applications) aims to address the fundamental new challenges related to the development of new functionally structured materials and to gain a deep understanding of the structure and dynamics of nanostructured matter on multiple length and time scales. Basic science investigation will be driven by the accomplishment of technology development for nanodevices

through experimental and theoretical interdisciplinary studies, aimed at endowing materials with specific local properties. Two types of devices will be investigated: DNA planar architectures exploitable as “mother boards” for self-assemblage of functional components to build functional nanodevices at negligible production cost and devices based on interface-enhanced charge conductivity where the understanding of the interplay on a nanometric scale between ionic conductivity and local physico-chemical properties will be exploited for the development of micro Solid Oxide Fuel Cells (µSOFCs). META goal is to establish a strong collaborative network between research centres in the EU (Italy, Slovakia) and in the USA. Such collaboration is addressed to tackle the variety of scientific and technological issues raised by enhancement and engineering of materials functional properties both at the nano and meso scale. Several bilateral visits, training workshops and meetings are planned with the framework of the project. Education will also be an important issue in this project, since exchange of graduate students and the opportunity of creating a joint PhD initiative is programmed. META will thus amplify the collaborative links between the EU and the USA giving European Scientists the opportunity of achieving rapid access to world top laboratories. The project meetings and conferences will attract scientists from other universities and industrial companies which would be highly beneficial for the present partner institutions and ERA in whole.

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**NBR: 269207** **ACRONYM: PAS** **EC FUND: 493900**

**DG:** REA **Call: FP7-PEOPLE-2010-IRSES** **Thema:** FP7-PEOPLE-2010-IRSES

**Title:** Patterns and Surfaces

**Abstract:** The proposed international partnership with the US, Japan, Canada and Russia as third countries and France, Turkey and Israel as beneficiary counties is focused on multi-phase flows that have technological applications. The science focus will be pattern generation, mixing, instabilities, and the control of such flows. The partnership has unique research aspects. The substantial resources of the partner countries in the target research areas will create a super-class status for the current research programs in the field. More importantly, early researchers from the beneficiary countries will receive an outstanding experience and become more marketable in the 21st century workplace. Intellectual Impacts: The partnership will advance multiphase fluid and thermal sciences with several technological applications including bio-sensors, drug delivery devices, flow instability and space enabling technologies for a multitude of industries related to pharmaceuticals, metallurgy and energy. Key science issues associated with patterns and instabilities in multiphase flows will be resolved. The proposed collaboration will by virtue of its impact encourage ultimate partnerships between industry and academe and benefit the economy of the Europe and Associated Countries. Broader Impacts: The project will enhance the training of several young researchers in cutting edge international research settings. Dissemination will be achieved by journal publications,

webminars and web sites. Transfer of Knowledge: The combined expertise of partner and MS/AC countries will result in transfer of knowledge via site visits and workshops. It will include numerical and analytical methods ranging from spectral and finite volume methods to weak nonlinear techniques as well as experimental techniques associated with nanotechnology to microgravity. The transfer of knowledge will take place in both directions and will become the permanent foundation for sustained collaboration.

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**NBR: 269219** **ACRONYM: ECNANOMAN** **EC FUND: 390600**

**DG:** REA **Call: FP7-PEOPLE-2010-IRSES** **Thema:** FP7-PEOPLE-2010-IRSES

**Title:** European and Chinese Platform for Nano Handling, Assembly and Manufacturing

**Abstract:** The project ''European and Chinese Platform for Nano Handling, Assembly and Manufacturing (ECNANOMAN)'' focuses on the staff exchange between the partners of EU and China, and on the development of new nano handling, assembly and manufacturing technologies. It meets the objectives and requirements of the Marie Curie Action: International Research Staff Exchange Scheme (IRSES), by setting up multiple bridges between European and Chinese institutions. The ultimate goal of ECNANOMAN is to establish a long-term research cooperation platform between Europe and China in an emerging field with promising applications in many areas such as nanomedicine, environmental science, nanoelectronics, nanophotonics and manufacturing. The synergistic approach made by ECNANOMAN will keep the consortium's leading position in the world for potential major scientific and technological breakthroughs. The project is divided into five inter-related work packages: (1) Setup of knowledge base and road mapping, (2) Nano handling tools and techniques, (3) Nano assembly and manufacturing, (4) Dissemination and exploitation, and (5) Project management. The workpackages integrate all activities that will lead to the completion of all the project objectives within 36 months.

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**NBR: 269267** **ACRONYM: ENSOR** **EC FUND: 264900**

**DG:** REA **Call: FP7-PEOPLE-2010-IRSES** **Thema:** FP7-PEOPLE-2010-IRSES

**Title:** Evolving Nanocarbon Strategies in (bio-) Organic Remits

**Abstract:** The ENSOR project involves the exchange of key staff between the EU (United Kingdom and Hungary), Russia and Japan with a principal aim to focus on the controlled production and chemical modification of a variety of novel nanocarbons for specific end applications reaching into the bio-organic field. Specifically, we will tailor the geometry and physicochemical properties of nanocarbons for the development of biosenors, rapid

bacteria screening in liquid media, DNA therapeutics, regeneration of damaged cells (peripheral nerve cells) and hemoperfusion adsorption. It is also recognised that the development of novel nanocarbons will have unique properties that will be beneficial in other research and development fields, e.g. next generation of ultracapacitors, advanced organic decomposition catalysts, superior mechanical reinforcement additives. Furthermore, the project provides training and education through collating the best techniques available within each country to provide international excellence, facilitating transfer of knowledge and know how between the participating parties, being of mutual interest, fostering long term collaborative format well beyond the scope of the project. To ensure success of the project, it is necessary to organize joint investigations of four teams from the University of Brighton (UoB, UK), Budapest University of Technology and Economics (BME, Hungary), Omsk University (Omsk, Russia), Kazan State University (KSU, Russia) and Toyo University (Toyo, Japan). The complementarily aspects existing between EU partners and those from Russia and Japan, as well as the multidisciplinary character of proposed research will create sufficient synergy to succeed the targeted goals and will result cross-fertilization of the consortium as a whole.

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**NBR: 269271** **ACRONYM: TELASENS** **EC FUND: 269800**

**DG:** REA **Call: FP7-PEOPLE-2010-IRSES** **Thema:** FP7-PEOPLE-2010-IRSES

**Title:** Carbon Nanotubes Technologies in Pulsed Fibre Lasers for Telecom and Sensing Applications"

**Abstract:** Nanostructures such as carbon nanotubes (CNT), quantum dots, nanowires, are prime candidates as building blocks in nanotechnology, because they assemble themselves and have a combination of unique electronic, optical, thermal and mechanical properties. The optical properties of nanomaterials mainly depend on their size and shapes and can be optimized in a very broad spectral range. Importantly, such materials can display the resonant optical nonlinearities useful for generation of ultrashort pulse lasers, pulse shaping applications and noise suppression. Our goal is to create an ambitious research exchange program, with a strong interdisciplinary nature, crossing materials engineering, physics, chemistry and soft matter sciences to achieve a major breakthrough in the understanding of the optical properties of nanomaterials. This knowledge will be useful for development of efficient nonlinear optical (NLO) devices, using novel speciality fibres and waveguides. The final target of the program is implementation of a NLO device in fibre lasers in order to achieve ultrashort pulse generation in the optical range important for telecommunication, environmental and biological sensing. The exchange program will benefit from participation of leading experts in nanomaterials, optical spectroscopy, computation chemistry, fibre optics and lasers from both EU and Partner countries. Therefore it will be a very attractive and useful opportunity for training of early stage researchers.

**NBR: 269279** **ACRONYM: NANOCIS** **EC FUND: 430500**

**DG:** REA **Call: FP7-PEOPLE-2010-IRSES** **Thema:** FP7-PEOPLE-2010-IRSES

**Title:** Development of a new generation of CIGS-based solar cells

**Abstract:** The main objective of NanoCIS is the establishment of a cooperative partnership between research organizations through a joint program of exchange of researchers for developing a new generation of photovoltaic (PV) solar cells. This new generation of PV solar cells will be based in approaches involving the use of new materials with high conversion efficiencies and low-cost fabrication techniques. The broad aim is the theoretical and experimental design, synthesis and characterization of new advanced materials, based on chalcopyrites absorbers, allowing the manufacture of an intermediate band solar cell. New concepts such as Intermediate band and luminescent materials for further development of CIGS solar cells are going to be investigated. This new class of materials has been predicted theoretically as potential candidates for providing very high efficiency (63%) in solar energy conversion. According to present knowledge, this compounds based on chalcogenide-type semiconductors are quite novel as general materials, especially in their application to solar energy. Electrodeposition (ED) is the technique chosen for developing such approaches. ED is essentially a non-vacuum approach to fabricate high quality thin-film materials for PV modules that could lower the manufacturing costs by over 50% and increase the PV module efficiencies. The ED technique offers the most attractive range of benefits leading to the low cost fabrication of PV cells, such as high rate of deposition, high resolution, high shape fidelity, self purification, scalability and good compatibility with existing processes. ED adds another cost effective step in low-cost solar cell because the transparent conducting oxide layers (TCO) can be deposited by the same method. The use of inline processing through an exclusively non-vacuum technique will further contribute to the improvement of device performance.

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**NBR: 269289** **ACRONYM: ELECTROACROSS** **EC FUND: 370900**

**DG:** REA **Call: FP7-PEOPLE-2010-IRSES** **Thema:** FP7-PEOPLE-2010-IRSES

**Title:** Electrokinetics across disciplines and continents: an integrated approach to finding new strategies to sustainable development

**Abstract:** The socio-economic activities due to world development are promoting increasing pressures on land, creating competition and conflicts, resulting in suboptimal use of resources. Integrated planning and management of land resources is a top subject of

Agenda 21 (managed by FAO), which deals with the cross-sectoral aspects of decision-making for the sustainable use and development of natural resources. This is essential for life-support systems and its productive capacity. In this context, there is a need to find new strategies for sustainable development that links social and economic progress with environmental protection and enhancement. Electrokinetic transport processes (EK) uses a low-level direct current as the "cleaning agent". EK has been applied to the remediation of polluted soils and other contaminated matrices. It also shows a great potential to be used in different fields, as in saline soil restoration, nutrients recovery from wastes or repair and maintenance of building structures. EK may be an integrated approach for new strategies aiming at sustainable development and to support waste strategies, with worldwide interest. EK can also be coupled with phytoremediation and integrated with nanotechnology, enlarging the scope of its application. The conciliation of the EK in the recovery of secondary resources, remediation and conservation is a multidisciplinary novel approach that opens new technical possibilities for waste minimization, through upgrading of particulate waste products and the recover of secondary resources for industrial, agricultural or social use. This objective is achieved through knowledge transfer activities, among a network of European and other continents centres of excellence, consolidating an European School of Electrokinetics. Joint new research on fundamentals and applied EK and its optimization will develop new strategies for sustainable development and the solutions achieved will result in a social-economic impact.

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**NBR: 269304** **ACRONYM: PHOTOCONTROL** **EC FUND: 76000**

**DG:** REA **Call: FP7-PEOPLE-2010-IRSES** **Thema:** FP7-PEOPLE-2010-IRSES

**Title:** Design of photocontrollable polyelectrolyte-based nanoengineered container systems

**Abstract:** The objective of the project is to provide a joint comprehensive research on the development of light-sensitive active coatings and light-addressable microdispensors based on the incorporated mesoporous photocatalytic particles loaded with active agent (lubricant, biocide, corrosion inhibitor). The coating will include container either with the inorganic scaffold made of photoactive material (TiO2) coated with polyelectrolyte shell or inert scaffold (SiO2) coated with polyelectrolyte/nanoparticles shell where the introduced nanoparticles are sensitive to the external light. The encapsulation employing Layer-by-Layer (LbL) electrostatic adsorption of polyelectrolyte molecules or charged nanoparticles represents novel and very efficient approach to creation of micro- and non-sized container structures with controlled composition and permeability of the shell for protection, delivery and storage. Of principle importance is a fact that the permeability of the polyelectrolyte containers' walls can be effectively modulated by introduced nanoparticles making it sensitive to the heat, UV or visible light as well as alternating magnetic field.

**NBR: 271554** **ACRONYM: SE2ND** **EC FUND: 2480264**

**DG:** CNECT **Call: FP7-ICT-2009-C** **Thema:** ICT-2009.8.0

**Title:** Source of Electron Entanglement in Nano Devices

**Abstract:** SE2ND is a joint experimental and theoretical effort. SE2ND strives to develop a highly efficient and continuous solid-state source of spatially separated spin-entangled electrons. A source of this kind, integrated with other electronic elements, will be of great importance in future quantum processors, where they provide, for example, entanglement distribution required to synchronize quantum circuits, and enable secure communication. The project will exploit entangled electron pairs that naturally occur in the ground state of a superconductor. The key target device of SE2ND is an electron-pair splitter with two defining key functions: 1) it ensures that pairs are emitted one by one, and 2) the two electrons of the pair are spatially separated by directing them into two different output channels, while maintaining their entanglement. Both objectives can be realized in carefully tuned double quantum dots. Hybrid double quantum dots will be realized in high-quality low-dimensional materials (semiconducting nanowires, carbon nanotubes and graphene) and integrated together with superconducting injectors, serving as sources of the electron pairs, ferromagnetic elements and microwave cavities in order to assess the degree of pair splitting and electron entanglement. SE2ND will explore the relevant material and fabrication parameters, optimize the splitting efficiency, assess the spin relaxation rate, coherence and the degree of entanglement to provide an optimized source with near to unity efficiency. SE2ND will extensively develop hybrid nanodevices which exploit the unique properties of quantum dots in proximity to superconductors and ferromagnetic materials, thereby providing a novel toolbox for electron-based quantum information technology, helping to maintain Europe at the forefront of this rapidly evolving field.

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**NBR: 272389** **ACRONYM: CAMLC10** **EC FUND: 209092**

**DG:** REA **Call: FP7-PEOPLE-2010-IEF** **Thema:** FP7-PEOPLE-2010-IEF

**Title:** Fabrication of Large Loading Capacity, Stimuli-Responsive and Release-Controlled Drug Delivery Nanodevices

**Abstract:** The target of the present project is to fabricate large loading capacity, stimuli-responsive drug delivery nanodevices (DDNDs) with potential application in anticancer therapy. The proposed theme is central to People Programme for Career Development framed under FP7 within a research area which is truly at the cutting-edge and which is strongly

interdisciplinary (materials, chemistry and nanoengineering). The proposed work falls directly under "The European Strategy for Nanotechnology and the Nanotechnology plan". In particular, there are two themes under this Action Plan addressed by this proposal, e.g. Health and NMP (Nanosciences, nanotechnologies, materials and new production technologies). The proposal involves both materials preparation and drug loading/releasing processes. The DDNDs will be made in three steps. Firstly, magnetic Fe3O4 nanoparticles (NPs) are prepared. Then a decomposable FeOOH shell will be coated on the NPs. Finally, the above core-shell structures will again be coated by a layer of mesoporous silica forming core-double shell structure. The DDNDs with increased hollow volume will be obtained by the decomposition of the FeOOH inner shell. Thereafter, the drug loading and releasing will be done in two separated steps where the release can be triggered by a stimulus input, e.g. sharp pH change. All structures/devices obtained from these steps will be thoroughly characterised. The evaluation on the delivery efficiency and improvement on the fabrication process parameters will be made according to the characterisation results. In particular, the 'zero-release' before the stimuli input, the load maximization per DDND and the sustainability of the release once triggered will be the main aims to be achieved in the project. As fulfilled, all pre-set training objectives will be realised by the knowledge and competencies gained in the project and will definitely benefit to the candidate career development and mobility among the European Research Area.

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**NBR: 272404** **ACRONYM: MOLHENANO** **EC FUND: 162742**

**DG:** REA **Call: FP7-PEOPLE-2010-IEF** **Thema:** FP7-PEOPLE-2010-IEF

**Title:** Molecular Aggregation and Microsolvation in Ultracold Helium Nanodroplets

**Abstract:** The aim of the project MOLHENANO is to carry out the study of molecular aggregates (pyridine clusters; amino acid clusters; acids and amino acids microsolvated in water) embedded in superfluid helium nanodroplets by means of high resolution infrared spectroscopy at the Physical Chemistry Department II of the Ruhr-Universität Bochum (RUB). In the first part of the project, Pyridine molecules will be studied as an example for molecular aggregation processes. The study deuterated and fluorated pyridine will be studied to determine the effect of charge and mass distributions in the dimer formation. The results that will be obtained for the dimer can be used to predict intermolecular interactions in large aggregates. In a second part of the project the applicant will continue the investigations already started on the microsolvation of hidrogen cloride. Specifically the effect of the deuteration on the dissociation mechanisms will be explored. The microsolvation investigations will be extended afterwards with the study of the amino acids arginine and phenylalanine. Specifically the question of which form, neutral or zwitterion, is present for each experimental condition will be addressed. In particular a systematic study on increasing the number of water molecules will be carried out to determine how many water molecules are necessary for

the transition to zwitterionic configuration. After concluding the above experiments the interaction of two amino acid monomers will be studied. Since there is no thermal energy available inside helium nanodroplets the final configuration for the dimer would differ from the absolute energy minimum configuration. Explore this striking effects will be another aim of MOLHENANO project.

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**NBR: 272448** **ACRONYM: NANODIA** **EC FUND: 219500**

**DG:** REA **Call: FP7-PEOPLE-2010-IEF** **Thema:** FP7-PEOPLE-2010-IEF

**Title:** Nano-diamond building blocks for micro-device applications

**Abstract:** The aim of the proposed project is to initiate a new research line on the development of nano-diamond building blocks for micro-devices. Diamond is a superlative engineering material combining exceptional thermal, mechanical, and chemical properties. Nano-grained diamond is of large scientific and technological interest since it could lead to several breakthroughs in micro-engineering, like e.g. for the synthesis of micro-electromechanical systems. Such nano-diamond deposits could replace silicon and other well-established materials that are unsuitable under extreme conditions, and could help to tackle the reliability issues due to friction and wear in numerous micro-device applications. This project will address several key aspects related to the growth, structure, and function of nano-diamond deposits that still impede their breakthrough for micro-scale applications. The key objective is the controlled synthesis of complex-shaped, 3-D micro-structured nano-diamond deposits with large aspect ratio displaying very low surface roughness, high film conformality, and well-controlled material properties. That will be achieved by acquiring a deeper understanding and control of the early stage formation of nano-diamond thin films on micro-patterned substrates. The Fellow will combine advanced diamond growth techniques with new developments in atomic layer deposition and miniature device fabrication. He will develop a two-pronged approach using experimental procedures and computer simulations to understand and tailor the nucleation and growth dynamics of nano-diamond thin films. Surface micromachining technology will then be applied for micro-patterning the nano-diamond. For the first time, recently developed micro-device tribometers will be used to assess the tribomechanical performance of nano-diamond at micro-contacts. The research will be carried out in four subprojects axed around two specific applications: (1) micro-fluidic delivery systems and (2) micro-machines.

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**NBR: 272470** **ACRONYM: IPMAGNA** **EC FUND: 167065**

**DG:** REA **Call: FP7-PEOPLE-2010-IEF** **Thema:** FP7-PEOPLE-2010-IEF

**Title:** Imaging the Plasmonic Activity of Magnetic Nanostructures

**Abstract:** The proposed project concerns the study of magnetoplasmonic systems, that is nanostructures exhibiting both magneto-optic (MO) properties and surface plasmon resonances (SPRs). Particularly, localized SPRs appearing in magnetic nanostructures will be studied using local probe microscopy techniques. The typical magnetoplasmonic nanostructure is a Noble-Metal/Ferromagnetic-Metal/Noble-Metal trilayer. They can be fabricated either as continuous thin films that are subsequently patterned using lithography and etching, or by lithography, evaporation and lift-off. Nanostructure arrays will be fabricated in various compositions, shapes, separations and symmetries (in particular, colloidal lithography will be used to obtain disordered arrays, whereas e-beam lithography will be used to prepare ordered ones). First, their collective optical and MO behavior will be characterized using far-field measurements. Afterwards, the local electromagnetic near-field distribution at single objects will be imaged using Scanning Near-field Optical Microscopy (SNOM). The local measurements will be correlated to the optical and MO collective measurements. Both optical-fiber SNOM and apertureles SNOM (aSNOM) measurements will be performed. Metal-coated Atomic Force Microscopy (AFM) tips will be used for aSNOM. The interest is in performing aSNOM using ferromagnetic-metal-coated AFM tips, thus allowing for Magnetic Force Microscopy (MFM) measurements to be performed simultaneously with SNOM. The illuminated light will excite surface plasmons, and the magnetic component of their electromagnetic field distribution will be imaged using MFM. Magnetoplasmonics research has been pioneered at the host group, and the proposed project is a natural continuation of the so far host activity. Magnetoplasmonics allow for the development of active plasmonic devices (their properties can be tuned with a magnetic field), with applications in photonic nanocircuits and advanced biosensors.

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**NBR: 272612** **ACRONYM: NANOLEDS** **EC FUND: 199549**

**DG:** REA **Call: FP7-PEOPLE-2010-IEF** **Thema:** FP7-PEOPLE-2010-IEF

**Title:** A Novel Approach to the Fabrication of Nanoscale Light Emitting Diodes

**Abstract:** Research in Nanoscience and Nanotechnology will drive the scientific and technological development of future years with revolutionary perspectives in many aspects of our society. Future large-volume applications will require fast and flexible methods to fabricate and miniaturize electronic and photonic components. This proposal will develop a novel approach to the fabrication of nanoscale light emitting diode (LED) and single quantum dot (QD) LED devices that exploits the laser-driven diffusion of hydrogen in III-V and III-N-V semiconductors. This project will impact a wide community. In fact, nano-LEDs have potential for several applications and interdisciplinary research, i.e. intra- and inter-chip communication, ultrahigh-density information storage, bio-imaging, etc.; also, single-QD LEDs will provide opportunities for fundamental studies of low

dimensional structures and their exploitation in nanophotonics. Therefore, this programme of research is well suited to tackle important challenges faced by our society and to generate the knowledge needed to ensure the leadership of Europe in a rapidly growing field. This fellowship will offer Dr. G. Pettinari opportunities to acquire complementary competencies and skills and to reach a position of professional maturity and independence. The fellow will work in an internationally leading institution, The University of Nottingham, with a strong tradition in condensed matter and semiconductors research. The host institution will benefit from hosting a promising researcher whose innovative proposal and previous experience in hydrogen studies and III-N-V alloys will complement an existing research activity at Nottingham on the fabrication of nanoscale LEDs. Of particular interest is the proposal of using hydrogen in the miniaturization of photonic components. This approach has the potential to be implemented in different semiconductor systems and devices, thus opening realistic prospects for a wide range of applications.

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**NBR: 272919** **ACRONYM: ELEGANT** **EC FUND: 264436**

**DG:** REA **Call: FP7-PEOPLE-2010-IIF** **Thema:** FP7-PEOPLE-2010-IIF

**Title:** Extraordinary Laser-induced Excitations in Glasses: Analysis and Theory

**Abstract:** The Project aims comprehensive experimental and theoretical studies of interaction of ultrashort laser pulses with optical glasses in order to reveal mechanisms of formation of extraordinary structures induced by laser radiation inside the bulk glass and to establish principles of controlled generation of desired glass modifications for applications in photonic devices. Optical glasses have become the key materials of optoelectronics and photonics applications due to their relatively low costs, processability, and possibility to govern refractive indexes. Recent research has shown that, applying femtosecond laser pulses to glass materials, one can create three-dimensional patterns with nano-scale features whose origin has not yet been understood. These findings can open new opportunities for a broad variety of microsystems with nanofeatures. However, further development of laser-writing techniques for controllable generation of desired modifications in transparent materials is impossible without deep understanding of the governing mechanisms of laser-driven material transformations. The Project will overcome the gap between the striking experimental findings of laser-induced glass modifications and theory which is still unable to explain a number of laser-created extraordinary structures. The objectives of this multidisciplinary project are (1) to disclose the nature of formation of volume nanogratings in fused silica; (2) to find mechanisms responsible for anisotropy of direct writing of optical elements dependent on the direction of laser beam scanning; (3) to describe bubble chains formation in glasses, and (4) to develop a concept of laser-induced modification diagrams for transparent materials. Its real outcome will be in making an important step from a primitive concept of simple energy deposition on laser processing of materials toward

understanding and more sophisticated description of overall phenomenon of laser-matter interaction.

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**NBR: 272957** **ACRONYM: BIOMAP** **EC FUND: 210092**

**DG:** REA **Call: FP7-PEOPLE-2010-IIF** **Thema:** FP7-PEOPLE-2010-IIF

**Title:** Simultaneous Elemental and Molecular Imaging of Biological Targets â€“ A New Paradigm for the Study of Disease and its Treatment

**Abstract:** This project proposes the development of a technology capable of delivering, high speed, simultaneous elemental and molecular maps of biological targets. Specifically these targets will include plaques associated with age-related macular degeneration (AMD), tumours treated with Pt-based chemotherapy drugs, and cell populations derived from the FP7 project, the ONE Study. The dual-mode imaging system will enable the analysis of metallo-proteins and their binding sites, or where there is no native metal tag or its abundance is too small to detect, anti-body or specific reactive chemistry metal or nano-particle tags will be added to the target molecules. For the ONE Study, one of the key project aims is to develop cell labelling strategies that will enable therapeutically administered cells to be tracked at low abundance in the host cell populations without toxic impact on either the therapeutic cells or host organism. The technology will be based on employing a common pulsed laser platform for laser ablation, desorption, or matrix assisted sampling of the target material simultaneously coupled with inductively-coupled plasma elemental mass spectrometry (ICP-MS) and ion trap organic mass spectrometry. In the case of the molecular mass spectrometry, electro-spray or matrix assisted charging will be used. The sampling will employ a technology developed in the host laboratory that enables targets to be sampled at atmospheric pressure whilst excluding atmosphere from the sampling point. The technology will be optimised for high speed and high efficiency to enable rapid mapping of targets at very high sensitivity. This will require development of a new high efficiency torch design for ICP-MS and the novel use of micro-jet pumps to deliver samples to the mass spectrometers. The project will also take advantage of the Fellow's expertise in synchrotron X-ray techniques to obtain non-destructive and comparative analyses of the specimen materials.

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**NBR: 273014** **ACRONYM: MENCOFINAS** **EC FUND: 209592**

**DG:** REA **Call: FP7-PEOPLE-2010-IEF** **Thema:** FP7-PEOPLE-2010-IEF

**Title:** Magnetic Energy Conversion in Fine Nanoparticle Systems

**Abstract:** Magnetic energy conversion using nanoparticles is fundamental to many rapidly developing areas such as environment-friendly nanotechnologies or in biomedicine. Examples include the use of magnetic nanoparticles (MPs) in devices for magnetocaloric refrigeration or for heating in the hyperthermia treatment of cancer. Investing in these areas is imperative if the European Research Area and the European nanotechnologies industry it to gain a worldwide leadership. Essential are scientific developments and also professional training of researchers to provide them with skills in fundamental physics and applied technology aspects. The present proposal's aim in this direction is the career development of Dr. Hovorka combined with the enhancement of his scientific expertise in the field of MP systems. Despite their importance for applications, superparamagnetic and ferromagnetic MP mixtures have been poorly studied and, as a result, the effects of interactions and hysteresis on energy losses and heat generation can presently be analyzed only on the empirical level. The aim here is to develop a solid theoretical understanding of these issues by employing the state-of-the-art multi-scale and atomistic modeling approaches as well as large scale Monte-Carlo methods. The research will be carried out at the host University of York (UK) and benefit from the top-class computational research facilities and the long standing scientific and industrial experience of Prof. Chantrell, who is the world leading scientific contributor in the field. The inter-disciplinary expertise gained during the program as well as new perspectives gathered through the transnational mobility, will put Dr. Hovorka into an excellent position to build an entirely new research portfolio and to effectively interface with leading industry researchers and developers in the future. This will strengthen the European excellence and competitiveness in the research field of applied and fundamental nano-magnetism.

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**NBR: 273810** **ACRONYM: CRYSTALZEO** **EC FUND: 178601**

**DG:** REA **Call: FP7-PEOPLE-2010-IEF** **Thema:** FP7-PEOPLE-2010-IEF

**Title:** Crystallography-assisted synthesis of zeolites with tailored acid site distributions

**Abstract:** This research deals with a long-term objective in zeolite science: the control of acid site distribution by varying synthesis parameters. In most catalytic reactions, the performance of zeolite-based catalysts depends on the distribution of the acid sites at the nanoscale level. The aluminium atoms in the zeolite framework structure are responsible for the formation of the acid sites, so if their distribution can be tailored so can that of the acid sites. In spite of intense interest, no method for controlling the distribution of acid sites has yet been developed. The synthesis strategy I developed during my PhD research has allowed, for the first time, the distribution of acid sites in the zeolite ferrierite to be modified as a function of the organic structure directing agents (SDAs) employed in its synthesis. With the aim of converting this synthesis strategy into a general methodology applicable to any zeolite, an in-depth understanding of the interactions that are established between the organic SDA

molecules and the oxygen atoms of the framework is required. This will allow the SDAs appropriate for the control of aluminium distribution in other zeolites to be chosen rationally. Crystallography is a powerful technique for this purpose, as it can provide detailed information about the location of the organic SDAs within the pores of the zeolite, as well as about the location of the framework silicon and oxygen atoms. This innovative use of crystallography, not just to study the zeolites obtained, but also as a tool to facilitate the design of optimal synthesis conditions for other zeolites, ensures that these syntheses will not be carried out in a trial and error basis. The candidate will perform crystallographic studies at the ETH Zürich (host institution), and this training will be a key to the development of her scientific career, as the expertise in structural characterisation of zeolites will be a perfect complement to her solid synthesis background.

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**NBR: 273817** **ACRONYM: NEUROCHEMBIOTOOLS** **EC FUND: 185248**

**DG:** REA **Call: FP7-PEOPLE-2010-IEF** **Thema:** FP7-PEOPLE-2010-IEF

**Title:** Chemical biology approach to study the role of PDZ domain-mediated interactions in synaptic plasticity

**Abstract:** Complex dynamic protein-protein interactions are the base of protein-based networks in cells. Among them, the synaptic connection between two neurons is one of the most challenging. The postsynaptic density (PSD) at excitatory synapses in the brain is a prototypical example of protein-based network whose nanoscale structure and composition determines cellular function. Moreover, dynamic regulation of PSD composition and receptor movement into or out of the PSD is the base of current molecular theories of learning and memory. However, the nature of this regulation remains poorly understood partly due to the lack of tools that would allow disruption and control of specific interactions. Several key components of the PSD such as PSD-95 contain multiple PDZ domains and the interactions mediated by these small domains are involved in critical events such as synaptic targeting and anchoring of glutamate receptors (AMPARs, NMDARs). The aim of this project is to design and exploit original tools to better understand the role of PDZ domain-mediated interactions in the context of synaptic plasticity by employing a chemical biology approach associating synthesis, biophysical measurements and live cell studies. In particular two different aspects will be addressed: 1) development of efficient and specific competing biomimetic ligands that integrate the multivalent nature of these interactions and 2) spatio-temporal control of the disruption of these PDZ domain-mediated interactions by incorporating to the previous ligands photolabile caging groups. The specific targets comprise on the one hand the main synaptic PDZ domain-containing scaffolding proteins (PSD-95, SAP97, PSD-93 and SAP102) and on the other AMPA and NMDA receptor complexes. Finally, these tools will complement common biological approaches by allowing us to study localized and dynamic macromolecular events between endogenous proteins.

**NBR: 273820** **ACRONYM: CLUSTERCAT** **EC FUND: 209592**

**DG:** REA **Call: FP7-PEOPLE-2010-IEF** **Thema:** FP7-PEOPLE-2010-IEF

**Title:** NanoEngineering of Model Catalysts Based on Supported, Size-selected Nanoclusters

**Abstract:** In order to design new or refined model nanocatalyst materials for more energy efficient and economical chemical processes, the proposed project incorporates three key areas of nanoscience: (i) Nanoscale materials engineering: the synthesis of stable arrays of supported, size-selected nanoclusters (ii) Advanced characterisation techniques: Scanning Transmission Electron Microscopy, and (iii) Nanoscale process engineering: investigating the reactivity/selectivity and stability of the model nanocatalysts under realistic reaction conditions. The model nanocatalysts will be prepared using the state-of-the-art apparatus based on radio-frequency magnetron plasma sputtering source, which is coupled to a lateral Time-of-Flight mass filter for size-selecting the nanoclusters. The wafer dicing method will be employed, for the first time, to convert the planar nanocatalysts to a high surface area nanocatalyst powders. The three-dimensional atomic structures and the stability of the nanoclusters during reaction conditions will be investigated by a spherical aberration-corrected Scanning Transmission Electron Microscope (pre- and post-reaction analysis). Finally, the performance of the model nanocatalysts will be explored by conducting the liquid phase hydrogenation reactions over nanocluster powder samples. The relevance of the present project within the Marie Curie Framework is reflected in the knowledge transfer between the host expertise at University of Birmingham (i and ii) and the Fellowship candidate experience from the Technical University of Munich (i and iii). This will also bring together technical innovations developed across the European Universities. In addition, the intention of this project is to motivate industrial development toward the design of new nanocatalytic processes that are less toxic and require less material and energy. The success of this project will have significant impact in advancing the field of modern catalysis in the European Research Area.

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**NBR: 273822** **ACRONYM: NINFA** **EC FUND: 239221**

**DG:** REA **Call: FP7-PEOPLE-2010-IOF** **Thema:** FP7-PEOPLE-2010-IOF

**Title:** Nanostructure Injected Lasers for Ultra-High Frequency Applications

**Abstract:** This proposal is concerned with optically-injected nanostructure lasers, including quantum-dot and quantum-dash semiconductor lasers and the potentials of these devices for Ultra-High Frequency applications, including Terahertz (THz) technologies. In

particular, attention will be focused on long-wavelength devices, emitting at the very important telecom wavelengths of 1310 and 1550nm. The aim of this proposal is to analyze experimentally and in theory the effect of optical injection in several nanostructure lasers, including Fabry-Perot, Distributed-Feedback (DFB) and multisection DFB devices with quantum dot and quantum dash active regions. The investigations will include the analysis of the injection locking properties and the mapping of the different regions of nonlinear dynamics when the devices are subject to weak optical injection. In addition, the enhancement of the modulation bandwidth and resonance frequency when these devices are subject to high and ultra-high external optical injection will also be investigated throughout the Fellowship. The limits in the enhanced frequency response will be analyzed for different designed optically-injected nanostructure lasers and the prospects of these devices for use in Ultra-High Frequency applications will be explored. In particular, attention will be focused in pushing up the frequency response of these devices to the THz frequency range which has a wide variety of applications in very disparate fields, including communications, biology, medicine, security, sensing etc. Hence, the vision of this project will be the practical development of a Tuneable THz oscillator built directly from simple and compact photonic components such as nanostructure semiconductor lasers totally compatible with optical communications technologies.

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**NBR: 273837** **ACRONYM: SEE 2 SENSE** **EC FUND: 234887**

**DG:** REA **Call: FP7-PEOPLE-2010-IOF** **Thema:** FP7-PEOPLE-2010-IOF

**Title:** Image supramolecular binding processes on the molecular level by STM for fundamental understanding sensor

**Abstract:** The goal of the project is to image supramolecular binding processes on the molecular level with the purpose to gain fundamental understanding of how a sensor operates. This understanding will subsequently be applied as a basis for new sensor design. Scanning Tunneling Microscopy (STM) will be used to visualize single molecule binding events of analyte molecules to receptor molecules adsorbed at a surface. In addition to topography changes, STM will also give valuable information about changes in electronic properties of the receptor upon the binding. This information will be used in the design of new, extremely sensitive sensors based on carbon nanotubes and graphene. The highly interdisciplinary research will be carried out by a promising young European researcher at MIT (USA) under the supervision of Prof. T. M. Swager, and at the Eindhoven University of Technology (the Netherlands) in the group of Prof. R. A. J. Janssen.

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**NBR: 273900** **ACRONYM: GRAPH-COUPL** **EC FUND: 132968**

**DG:** REA **Call: FP7-PEOPLE-2010-IEF** **Thema:** FP7-PEOPLE-2010-IEF

**Title:** Spectral analysis of graph-coupled systems

**Abstract:** The analysis of thin branched structures has become very popular in Mathematical Physics during recent years. One reason is the increasing technological feasability of manufacturing nano-structures at an atomic level, making a detailed quantum mechanical analysis of the problem necessary. Thin branched structures occur e.g. in micro-electronics or in opto-electronics; and a theoretical analysis is necessary in order to understand the behaviour of such media or to engeneer materials with certain properties. One is for example interested whether a material conducts or transmits light or not, e.g. semi-conductors or photonic crystals. The project aims in a mathematical analysis of thin branched structures providing a large class of (at least approximatively) solvable models. One goal of the project is to what extend thin branched structures can be understood by their decomposition into simple building blocks according to the underlying network structure. By this decoupling method, we want to tackle open problems in Mathematical Physics like the extended states conjecture, i.e., the question whether a randomly perturbed periodic medium still allows transport for small perturbations. Another goal of the project is the question whether thin branched structures and their properties can approximately be described by the pure one-dimenional limit, the underlying network structure. Olaf Post, the researcher of the proposal, is an expert on the theory of thin branched structures in the zero-thickness limit. Marco Marletta, the scientist in charge, is a recognized top-level specialist in the mathematical analysis of partial differential operators and their spectral properties and in operator theory. Our project brings together these two very active areas of Mathematics, and aims in providing concrete mathematical models which are useful in engineering nano-structure devices.

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**NBR: 273940** **ACRONYM: SANDPAPER** **EC FUND: 205534**

**DG:** REA **Call: FP7-PEOPLE-2010-IOF** **Thema:** FP7-PEOPLE-2010-IOF

**Title:** Synthesis and Assembly of Nanostructured Devices for Photovoltaic And Photocatalyic Energy Reservoirs

**Abstract:** This proposal aims to develop a career path in academic and industrial research for the proposed fellow by immersing the proposed fellow in an advanced research environment in UC Berkeley, while working on a project that seeks to improve the state-of-the-art technology in renewable energy, an area of increasing importance. The over reliance on fossil fuels causes socio-economic problems, through environmental and sustainability issues. Photovoltaic (PV) and photocatalytic (PC) energy conversion are set to displace fossil fuels in energy production. Current PV devices have a high cost and

long payback time due to the complicated techniques involved in production. II-VI semiconducting materials such as Cd(S,Se andTe) display excellent photovoltaic properties, enabling their use in high efficiency PV devices – properties significantly improved when in a low dimensional nanocrystal, such as nanorods (NRs). These NRs can be produced and organised using low-cost, low-energy solution-based methods. Current architecture of devices based on NRs limits efficiency. This project will improve efficiencies in these devices by altering the architecture. Langmuir-Shafer deposition will create II-VI NR/polymer devices with high interface area to maximize efficiency. Heterostructures of these materials will be used to photocatalytically split water in to oxygen and hydrogen – a clean fuel alternative, circumventing electrical engineering problems inherent in PV devices. Micelle formation through phase exchange will improve efficiency over existing PC devices by increased light scattering. These structures can also be made into discrete PV devices, which can be assembled into cooperative large scale devices. The fellow will also acquire complementary skills that will enable him to become an effective researcher through training courses and one-on-one interactions in an international environment and will be re-integrated in a research in Ireland that will utilize the skills acquired.

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**NBR: 274039** **ACRONYM: NANOSOIL** **EC FUND: 168863**

**DG:** REA **Call: FP7-PEOPLE-2010-IEF** **Thema:** FP7-PEOPLE-2010-IEF

**Title:** Nanoscale processes in soils: The role of mycorrhizal fungi in aggregation and phosphorus acquisition

**Abstract:** Healthy soils containing sufficient mineral nutrition for plants are the basis for our natural ecosystems and food production. Nevertheless, a great proportion of our European soils are subjected to erosion and are infertile. For a better management, we need to better understand the mechanistic processes happening in soils at a nanoscale. Symbiotic arbuscular mycorrhizal fungi (AMF) are important for both soil aggregate built-up via their extensive hyphal network and protein production; and supply their host plants with nutrients, especially phosphorus (P). I will study the dynamics of soil aggregation with a rare earth element labelling approach, and the protein structure of AMF derived soil macroaggregates with the help of synchrotron radiation based microscopy. AMF produce a protein called glomalin which is highly correlated with soil stability, but we do not know the microscale role of this protein in soil aggregation yet. Concerning a sustainable P nutrition of plants, I will examine the role of AMF in acquisition of P from minerals and biochar. For this, I will apply Fourier-transformed infrared microscopy, with which I will measure removal of phosphate out of a thin surface layer on the Goethite and biochar. Concluding, I will evaluate possible consequences for soil management and soil ecosystem functioning.

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**NBR: 274046** **ACRONYM: HYBRIDSOLAR2010** **EC FUND: 218744**

**DG:** REA **Call: FP7-PEOPLE-2010-IOF** **Thema:** FP7-PEOPLE-2010-IOF

**Title:** Development of inorganic / organic hybrid heterojunction solar cells

**Abstract:** Heterojunction hybrid solar cells, consisting of an organic electron donor and an inorganic oxide semiconductor electron acceptor, have attracted much attention in the past decade. In this type of solar cell, photons are absorbed in the p-type semiconductor polymeric layer, and the generated excitons (holes and electrons) are separately transported within different nanophases, resulting in considerably large charge carrier lifetimes. An effective approach to building the heterojunction is to infiltrate the organic polymer into an oxide nanotube array (NTA) framework, which has several key advantages: (a) vertically aligned NTA affords pathway for vectorial electron transfer; (b) light propagation can be optimized by controlling the pore diameter, wall thickness, and nanotube length; (c) the NTA offers high surface area while maintaining structural order; (d) carrier collection is optimized by the proximity of exciton diffusion distances (5-15 nm) to the oxide nanotube diameter. Efficient infiltration from solution of a high molecular weight polymer into the NTA host can be challenging. In situ approaches are more attractive, either chemical or UV polymerization has been deployed to synthesize polythiophene derivatives in the oxide host. Intrinsic electroactivity of a monomer precursor molecule can also be exploited to electrochemically infiltrate the polymer in situ into the NTA. We presented the feasibility of this approach by using poly(3,4-ethylenedioxythiophene) and TiO2 NTA recently. The aim of this work is that by combining our knowledge on inorganic NTAs and conducting polymers, we can exploit the advantages of electrochemistry in order to achieve the fine tuning of the composition and morphology of the composites. By optimizing all key processes (light absorption, exciton generation, charge transport) we will prepare hybrids possessing improved photo-electrochemical properties. The best performing materials will be utilized to fabricate solar cell devices.

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**NBR: 274078** **ACRONYM: BEC-ME** **EC FUND: 271636**

**DG:** REA **Call: FP7-PEOPLE-2010-IEF** **Thema:** FP7-PEOPLE-2010-IEF

**Title:** Microbial Electrochemical Cells with modified electrode based on â€˜forestâ€™ like carbon nanotube (CNTs) and CNT- conducting polymers nanocomposites

**Abstract:** Microbial electrochemical cells (MECs) show promises for energy recovery from waste and efficient wastewater treatment. MECs are bioelectrochemical reactors in which chemical energy stored in reduced substrates is converted directly into electrical energy (or hydrogen) through immobilized microbial catalysts, usually termed electroactive

biofilms (EAB). Current MEC performances are not optimal and prevent their use in large-scale applications. Slow electron transfer at the microorganisms/electrode interface and low overall electroactivity of EABs are among the key scientific bottlenecks that need to be resolved in order to increase MEC output and enable their cost-effective implementation in wastewater treatment plants (WWTP). A possible solution is the development of biocompatible advanced materials for electrodes that will enable efficient "wiring" of EAB to the electrode. This project focus on development of such electrode materials and their implementation in established MECs. The candidate will use 'forest' like carbon nanotube (CNTs) and CNT- conducting polymers nanocomposites (CNT-NCs) to modify conventional electrodes for MECs. The new electrodes will have high surface and biocompatibility and support a fully active EAB, thereby increasing extracellular electron transfer and power (or hydrogen) output in MECs. The training facilities and expertise of the host organization will be used to fulfill the multidisciplinary training of researcher needs for development of an independent research career. Additional training budget management and technology transfer provided within this project will add to the core skills of the candidate and enable her to take forward Research and Technology Development programmes. Moreover, the results could be of enormous global environmental benefit by ensuring the optimization of MEC as well as economic benefit by reducing costs for existing wastewater treatment systems.

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**NBR: 274081** **ACRONYM: MECARTUBES** **EC FUND: 200049**

**DG:** REA **Call: FP7-PEOPLE-2010-IEF** **Thema:** FP7-PEOPLE-2010-IEF

**Title:** IN-SITU FILLING OF CARBON NANOTUBES WITH METALS

**Abstract:** Metal-filled carbon nanotubes (CNTs) have attracted intense attention in recent years especially with view to applications in biomedicine such as drug delivery systems. This project concerns the development of in-situ filling CNTs with metals. Different magnetic metals such as Fe, Co, Ni and their alloys will be encapsulated in the inner cavity of the CNTs during growth. In order to achieve this objective, novel carbon vapor deposition experiments for the continuous process of filling CNTs will be explored. The methods proposed have the advantage that the growth and filling of the nanotubes take place simultaneously. The transition from lab to a large scale production will be explored. They will be based on the pyrolysis of metal-organic compounds and catalytic pyrolysis varying catalyst concentration in conjuction with filling facilitating compounds. The influence of the processing parameters (i.e deposition time, reaction temperature or influence of the catalyst particles) on the structure and magnetic properties will be studied in order to elucidate important parameters for the controlled mechanism formation and encapsulation of metallic particles. Structural and chemical analysis of metal-filled CNTs will be carried out by means of scanning and transmision electron microscopy, electron energy-loss spectroscopy or raman spectroscopy. Magnetic properties will be also evaluated. Functionalization of CNTs is the precondition for their

application in medicine. In this project, functionalization of the surface of filled-CNTs will be explored mainly by covalent functionalizations through oxidation with strong acids and employing the 1,3 dipolar-cycloaddition mechanism. As part of the last activity of the research, the project will overcome preliminary tests about the binding of therapeutic molecules with some kind of pharmacological activity for the treatment of complex diseases where activity is required at specific sites in the human body.

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**NBR: 274137** **ACRONYM: ADRENERGIC RECEPTORS** **EC FUND: 186028**

**DG:** REA **Call: FP7-PEOPLE-2010-IEF** **Thema:** FP7-PEOPLE-2010-IEF

**Title:** Crystallization and structure determination of adrenergic G protein-coupled receptor subtypes

**Abstract:** Crystal structures of beta1 and beta2 adrenergic G protein-coupled receptors (GPCRs) have been determined recently. We propose to extend the structural information about this physiologically and medically important GPCR subfamily by obtaining the structures of the beta3 and the alpha adrenergic receptors. The ample experience in GPCR structural biology of the host laboratory, complemented by its multidisciplinary approach, provides an ideal environment for this challenging task. We will make use of high-throughput facilities and methods to optimize the receptor constructs for expression and protein stability. We will use various crystallization methods and available robotic nano-liter dispensers to determine suitable conditions for crystal growth. We will have access to state-of-the-art microcrystallography beamlines at the Swiss Light Source synchrotron at Paul Scherrer Institut (PSI) to test a large number of obtained crystals and collect the best possible diffraction datasets. Once diffraction data of sufficient quality has been obtained, the structure will be solved by molecular replacement. In collaboration with other PSI scientists and external academic and industrial partners we will use the structural results obtained for the adrenergic receptor subtypes to study the structural basis of ligand efficacy, i.e. how the process of ligand binding is translated into receptor function, and to find applications in therapeutic drug development.

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**NBR: 274185** **ACRONYM: PING** **EC FUND: 189112**

**DG:** REA **Call: FP7-PEOPLE-2010-IIF** **Thema:** FP7-PEOPLE-2010-IIF

**Title:** Piezoelectric nanogenerators on suspended microstructures for energy harvesting

**Abstract:** Since micro- and nanotechnology already allow to design devices which only require minuscule amounts of power, the ability to convert "free" energy "harvested" from the

environment into electric energy has tremendous potential, especially with reference to implantable devices for medical applications and wireless sensors networks. However, existing approaches for energy harvesting are not sufficiently efficient, cheap, compact, and versatile; in particular, the output power of conventional integrable piezoelectric devices is rather low. Recently, Prof. Zhong Lin Wang has used arrays of ZnO nanowires as piezoelectric nanotransducers for harvesting mechanical energy; though several outstanding advantages of piezoelectric nanogenerators have already been demonstrated, existing nanogenerators are largely sub-optimal: first, external acoustic energy is not optimally transduced into deflection of nanowires; second, there can be significant differences among different nanowires in the array, thus reducing efficiency; third, despite its compatibility with practically all MEMS processing steps (in particular, growth temperatures below 100 °C are possible), the aqueous chemical growth technique does not currently allow to grow sufficiently long nanowires. The goal of this proposal is to deal with all these dominant issues of existing piezoelectric nanogenerators. In practice we will use a modified (low-temperature) aqueous chemical growth process with localized heating, in order to improve the nanowires homogeneity as well as to increase the nanowires length; such an approach will permit the co-integration of sufficiently long ZnO nanowires with suspended microstructures (diaphragms and bridges), which will allow the optimal transduction of incoming acoustic energy into deflections of nanowires. We expect that co-integration of suspended microstructure and sufficiently long piezoelectric nanowires will allow to harvest output power density up to about 1mW/cm2.

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**NBR: 274404** **ACRONYM: LUNAMED** **EC FUND: 210359**

**DG:** REA **Call: FP7-PEOPLE-2010-IOF** **Thema:** FP7-PEOPLE-2010-IOF

**Title:** NOVEL LUMINESCENT UPCONVERSION NANOPARTICLES FOR DIAGNOSTIC AND THERAPEUTIC NANOMEDICINE

**Abstract:** This proposal describes novel up converting nanoparticles that promise minimal perturbation of living systems. The work is at the leading edge of science in cell targeting, imaging and diagnostic medicine. The outgoing part will be carried out in the laboratory of Professor John A. Capobianco an internationally recognized scientist. His laboratory offers a unique, multidisciplinary environment for developing and applying novel nanoparticles in biomedicine. It includes also gain state-of-the-art expertise in nanotechnology and access to a diverse learning environment encompassing, spectroscopy, inorganic chemistry, synthesis and characterization of nanoparticles and will have access to world-class infrastructure. The incoming part of the proposal will be carried out in Prof. Daniel Jaque group, which have a great experience in optical spectroscopy as demonstrates their prolific scientific achievements.

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**NBR: 274505** **ACRONYM: USOM** **EC FUND: 186028**

**DG:** REA **Call: FP7-PEOPLE-2010-IEF** **Thema:** FP7-PEOPLE-2010-IEF

**Title:** Ultrastrong optomechanical coupling for quantum optomechanics experiments and novel radiation-pressure devices

**Abstract:** The coupling between light and mechanical motion through radiation pressure enables both fundamental experimental research into the quantum behavior of macroscopic objects as well as new technological applications such as light-actuated high-frequency resonators. Crucial to both is the realization of strong optomechanical coupling. We propose to develop novel optomechanical systems that exhibit ultrastrong interactions between light and motion to achieve cooling of a mechanical oscillator to the quantum ground state and to demonstrate new optomechanical functionality. Miniaturized silica toroidal resonators supported by 'spokes' serve as optomechanical resonators with small effective mass and ultra low loss, which are expected to enable ground state cooling. Moreover, we will use two-dimensional photonic crystal cavities in which phononic and photonic modes are highly co-localized to achieve ultrastrong coupling between a cavity mode and high-frequency mechanical oscillations. These systems can perform as all-optically tunable GHz oscillators. The strong coupling and low effective masses of these systems, as well as straightforward integration on a chip, make photonic crystal cavities promising candidates for a next generation of cryogenic quantum experiments. Finally, we will explore for the first time the possibilities of optomechanics in plasmonic systems, which concentrate electromagnetic fields in nanoscopic volumes to achieve giant light-matter interactions. The applicant, Ewold Verhagen, performed his PhD research at the FOM Institute for Atomic and Molecular Physics in Amsterdam, The Netherlands. He published a total of 15 papers in the field of nanophotonics. His main achievements include the demonstration of adiabatic nanofocusing of light and the realization of angle-independent negative index metamaterials at optical frequencies. The host is the Laboratory of Photonics and Quantum Measurement at the EPFL, led by Tobias Kippenberg.

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**NBR: 274515** **ACRONYM: NOBLEMED** **EC FUND: 228529**

**DG:** REA **Call: FP7-PEOPLE-2010-IOF** **Thema:** FP7-PEOPLE-2010-IOF

**Title:** Regulated release of Pt-based drugs from multi-component Au-nanocarriers

**Abstract:** The aim of the proposed research is to develop a new (Au-NP) gold nanoparticle-based drug delivery systems. For this new synthetic approach, three different components are designed; namely, new tailored gold nanoparticle, cleavable linkers, and new platinum-based drugs. The first component is a new tailored Au-NP, which will be synthesized

using a multidentate thioether “coating ligand”. Unlike the gold nanoparticle-based nanocarriers used till date, this novel nanomaterial enables accurate functionalization of the particle surface using a multidentate ligand, allowing also controlled particle size and shape. Moreover, tuning of the gold-surface properties is easily performed by functionalization of the coating ligand, leading to a well defined drug load per particle. The functionalization also enables the attachment of linkers (second component of the system) of a programmable variety on the outer-shell of the Au-NP, which will serve as bridges between the nanocarrier and the drug. The proposed approach is the use of cleavable linkers to reach a new level of drug-controlled release. Inspired by cancer biology, peptide linkers will be attached to the coating ligand of the gold nanoparticle. These peptides will be cleaved by overexpressed proteases in cancer tissue, achieving tumor-specific drug (endogenous) release. In addition, exogenous activation of drug release using photolabile linkers will be explored, leading to new class of external controlled platinum drug release. To test this approach, platinum-based drugs (third component), which display high cure rates against several cancers (ovarian, head neck, testicular and lung cancer), will be attached to the nanocarriers using different cleavable linkers. In addition to the synthesis and characterization of these systems, in vitro studies in cancer cells will be performed to investigate their cellular processing, and establish their mechanisms of action.

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**NBR: 274895** **ACRONYM: PRIMA** **EC FUND: 175844**

**DG:** REA **Call: FP7-PEOPLE-2010-IEF** **Thema:** FP7-PEOPLE-2010-IEF

**Title:** Priming in an aquatic ecosystem - Stream biofilms as hotspots for carbon cycling

**Abstract:** Recent findings concerning the role of inland waters in global carbon cycling is currently having a major impact of the view of the global carbon cycle. These findings highlight inland waters - such as streams, rivers and lakes - as major sites of carbon cycling, implying that they must be considered in the context of climate change. Microbial degradation of organic carbon is a process that is central to carbon cycling in all ecosystems. In soils, microbial degradation of recalcitrant carbon is often controlled by the availability of labile carbon sources. This is linked to the priming effect (PE). Mounting evidence suggests that PE is also important in aquatic ecosystems but it has yet to be explicitly addressed. Biofilms are vital components of aquatic ecosystems. In stream biofilms, heterotrophic bacteria and algae coexist in close proximity, exposing the bacteria to both recalcitrant organic carbon of terrestrial origin and labile organic carbon from the algae. This could make stream biofilms hotspots for PE. In PRIMA, I propose an innovative effort cutting across aquatic and terrestrial ecosystems, spanning single-cell to ecosystem scales, and combining methods from biogeochemistry and molecular microbiology to study PE in stream biofilms. Carbon flux in stream biofilm microcosms and in ecosystem scale stream mesocosms will be measured to quantify PE and its implications for carbon cycling in streams. The mechanisms of PE will be

addressed on single-cell and community scales using cutting edge methods, such as NanoSIMS and 454-sequencing. I am an experienced researcher trained in Norway and Sweden. In PRIMA, I seek to combine my existing skills with the unique expertise and facilities of Prof. Tom J. Battin at the University of Vienna. The many conceptual and methodological training objectives of PRIMA, as well as its outstanding scientific quality, will strengthen my scientific skills and will enable me to reach my goals as an independent researcher.

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**NBR: 274985** **ACRONYM: POLARCLEAN** **EC FUND: 200549**

**DG:** REA **Call: FP7-PEOPLE-2010-IEF** **Thema:** FP7-PEOPLE-2010-IEF

**Title:** Advanced methods for the removal and monitoring of polar organic contaminants

**Abstract:** The aim of the project is to develop advanced methdologies for the decontamination and monitoring of emerging polar contaminants in wastewaters and drinking waters. There are no known technologies for cleaning e.g. endocrine disruptors, molluscicides, acrylamide, which are major problems affecting the quality of drinking water world-wide and can degrade aquatic ecosystems. Methods based on micro- and nano-composite materials and heterogeneous catalysis with superior cleaning properties will be developed and applied to achieve efficient and environmentally friendly remediation technologies. The decontamination strategy will be further developed as a new high throughput analytical tool for monitoring trace amounts of pollutants in water. The project will tailor the structure of micro and nano-size carbon beads; nanotubes and graphene oxides to trap highly polar contaminants from water whose removal is not feasible today; embed the most effective structures in a polymeric matrix; and develop a process to decontaminate the material by means of heterogeneous catalysis where the adsorbent will act as catalyst in the degradation reaction. The carbon-based composites developed for water remediation will be optimised for use in analytical processes. The outputs of the research will contribute to the betterment of ecosystems and human health through the improvement of water treatment technologies, and science with new methodologies to trap, degrade and monitor highly polar contaminants from water. Removal and monitoring highly polar small-size molecules from water is a significant challenge and an urgent need of today.

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**NBR: 274999** **ACRONYM: IONBEATHETEROMAT** **EC FUND: 201049**

**DG:** REA **Call: FP7-PEOPLE-2010-IEF** **Thema:** FP7-PEOPLE-2010-IEF

**Title:** Ion beam techniques for the sub-nanometric characterisation of advanced energy conversion heterostructured materials

**Abstract:** The improvement, discovery or implementation of alternative energy sources represents one of the most dynamic and challenging trends in today´s research with connections to Materials Science, Applied Physics and Engineering, among others. In this context, current developments in high-efficiency energy conversion systems are based in the modification at the atomic level of heterostructured materials to improve the performance of devices such as solid oxide fuel (SOFC) and triple-junction solar cells (TJC). These two highly-engineered technologies demand specific analytical techniques with high spatial resolution to perform a chemical characterization capable of relating their structure and their functionality, particularly at the interfaces. In this project we will apply a novel instrumental configuration that combines surface science and surface analysis to probe materials surfaces and interfaces with unparalleled precision so that we will be able to better understand and optimise the materials we are developing. Two techniques, low energy ion scattering (LEIS) and time-of-flight secondary ion mass spectrometry (ToF-SIMS) are the best candidates to face such challenge due to their excellent surface sensitivity and depth resolution. The combined use of these ion beam techniques will provide an understanding of the surface and near surface processes in the latest generations of advanced materials. For this purpose, a deep understanding of the ion-solid interaction fundamentals is required in order to optimise the depth resolution and sensitivity of ToF-SIMS-LEIS to perform the most accurate and reliable analysis of the interfaces and nanometric domains in such heterostructured materials.

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**NBR: 275150** **ACRONYM: APPCOPTOR** **EC FUND: 180584**

**DG:** REA **Call: FP7-PEOPLE-2010-IEF** **Thema:** FP7-PEOPLE-2010-IEF

**Title:** Active and Passive Photonics with Coupled Optomechanical Resonators

**Abstract:** Manipulation of the matter properties with radiation pressure (optical) forces is one of the high-impact topics in the multidisciplinary area of Photonics. In a photonic system often the optical and mechanical modes can effectively couple giving birth to novel fascinating phenomena described through a new discipline - Optomechanics. In this context, in a system of coupled circular resonators, of which one is mobile and the other is a fixed one, the optical forces can control the position of the mobile cavity driving it into an optically generated ultra-narrow (picometer) trapping mechanical potential. This means that the mechanical properties of an optical device, in particular its position in real space can be precisely controlled via the use of light exclusively. Therefore this system enables possible applications ranging from all-optical switching and tuning to adaptive optical filters. The objective of this proposal is to realize effectively coupled waveguide/single (and double) resonator systems monolithically integrated into a silicon chip. The project will address both optically passive and active systems. In the passive

resonators we aim to demonstrate for the fist time optical trapping of an optomechanical resonator, while in the second case we will study optomechanical resonators containing silicon nanocrystals as active nonlinear material, with a final goal to demonstrate near-infrared range tunable optomechanical laser combs. Importantly, these fundamental physical phenomena will be studied in all-on-chip integrated silicon devices, thus opening door to immediate applications.

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**NBR: 276201** **ACRONYM: GRAPHENEGASSENSORS** **EC FUND: 280680**

**DG:** REA **Call: FP7-PEOPLE-2010-IIF** **Thema:** FP7-PEOPLE-2010-IIF

**Title:** Graphene-Based Ultra-Sensitive Gas Sensors

**Abstract:** Goal of the proposed research is to transfer the knowledge of experienced researcher to Europe. Detection of minor gas leaks in a hazardous work environment has been a challenging research problem for many decades as it involves health, safety and environmental risks. In this proposed research we will develop graphene based gas sensors with ultrafast response, high sensitivity, great selectivity and high durability to detect the environmental pollutants even in very low concentrations. We intend to target the detection of various toxic gases such as CO2, CO, H2S, NOx, ethanol, and SO2 in ppb level. Graphene is relatively a new material to be used for practical sensor purpose. The idea underlying the selection of graphene for sensor application is its variable conductivity, which makes it available for electron transport phenomena with very high electrical mobility in the presence of oxidizing and reducing gases. The feature of high conductivity will be exploited by using graphene as conductivity-based chemical gas sensors. The proposed study will allow the optimization of sensor parameters for making sensors with good selectivity for target gases by using metal catalyst such as Pt, Pd, and Au on the surface of graphene. The idea underlying the present proposal is that by coating graphene with metal nanoparticles, one could increase the effective surface area and modify the work functions, thereby improving the sensitivity and selectivity of the gas sensors. Successful completion of this research will have enormous benefit to European society through numerous applications, including the reduction of health risks and improvement of public security, detection of environmental toxins and semiconductor processing. Researcher Dr. Rakesh K. Joshi is expert in nanomaterials synthesis and sensor development while Prof. Andre Geim is the discoverer of graphene and its sensor application. Both researchers have worked extensively in graphene and gas sensors.

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**NBR: 276556** **ACRONYM: BAXHHG** **EC FUND: 166565**

**DG:** REA **Call: FP7-PEOPLE-2010-IEF** **Thema:** FP7-PEOPLE-2010-IEF

**Title:** Bright attosecond x-rays in the water-window using phase-matched high-harmonic generation

**Abstract:** We propose to develop a compact source of x-rays, with sub-femtosecond duration, near-perfect spatial coherence, and photon energy approaching 500 eV. Such a source will be an essential tool for attoscience and nanometre-resolution microscopy. In particular, the importance of sub-femtosecond dynamics is being appreciated in a rapidly growing range of contexts, including nanoplasmonics and charge migration in biomolecules. The transparency window of water (280 eV to 530 eV) is particularly attractive for structural and dynamical imaging of biological samples. We shall use high-harmonic generation driven by mid-infrared (2 micron) light. The principle advantage of a long-wavelength drive over the visible (800 nm) drive fields which currently receive much attention is the higher energy of the emitted x-rays photons, which scale with the square of the drive wavelength. There are also numerous potential technical advantages, including greater robustness through the use of intrinsically phase-stable mid-infrared sources based on difference-frequency generation, and greater brightness at high photon energies through improved phase matching.

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**NBR: 276574** **ACRONYM: GELBRID** **EC FUND: 189112**

**DG:** REA **Call: FP7-PEOPLE-2010-IIF** **Thema:** FP7-PEOPLE-2010-IIF

**Title:** pi-Electronic Gel Hybrids: Towards Smart Photoactive Nanomaterials"

**Abstract:** GELBRID is a 3-year project aiming at the preparation and extensive characterization of advanced gel hybrid materials. Three basic strategies will be addressed: (i) peptide-substituted linear pi-conjugated molecules to be gelated and (ii) used as scaffolds for the hybridization with inorganic nanoparticles and for (iii) noncovalent functionalization of graphene through self-assembly. The final target is (iv) a new gel hybrid system that, combining the above 3 strategies, incorporates their outstanding structural and electronic properties. The intrinsic features of the materials fabricated will make them attractive in applicative areas such as advanced nanomaterials, light harvesting, and solar energy conversion. The applicant has a seven-year research experience acquired in world class laboratories in India and Japan and will bring to Europe his expertise in the fields of design, synthesis, self-assembly and gelation of organic molecules as well as in the preparation of hybrid nanomaterials. The host institution (CNR, Italy) will offer him an internationally recognized expertise in the area of advanced physical characterization, supramolecular chemistry, and photosciences. The mutual transfer of knowledge will allow to gather the intellectual and infrastructural critical mass needed to reach the ambitious goal of preparing fully characterized unprecedented organic-inorganic hybrid gel nanomaterials fabricated through self-assembly. The original

concepts elaborated in GELBRID are expected to have a noticeable impact in materials science, also thanks to their potential in solar conversion technologies that are currently growing at an impressive pace. The one-year return phase to India is intended to be an instrument to reinforce the scientific cooperation between India and Europe, also taking advantage of an already existing network of collaboration between the host institution and a number of big companies, SME and academic institutions all across the continent.

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**NBR: 276595** **ACRONYM: WISE** **EC FUND: 178101**

**DG:** REA **Call: FP7-PEOPLE-2010-IEF** **Thema:** FP7-PEOPLE-2010-IEF

**Title:** Nanowire Structures for Energy Conversion

**Abstract:** Semiconducting nanowires and in particular their heterostructures could be of paramount importance for energy conversion. These structures hold great potential to provide a means of manipulating phonons by preserving the electronic properties. Our primary goal is to provide novel semiconductor nanostructures possessing enhanced phonon scattering which leads to a selective reduction of thermal conductivity without affecting the electrical characteristics. This will be achieved by developing the growth of III-V Nanowires and heterostructures based on InxGa1-xSby and analyzing their structural, electrical and thermal characteristics.

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**NBR: 276805** **ACRONYM: CARBOTRON** **EC FUND: 45000**

**DG:** REA **Call: FP7-PEOPLE-2010-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Carbon-based nanoelectronics

**Abstract:** Molecular electronics has the potential to go well below the size limitations of silicon-based electronics, such that the well known Moore's law can be maintained for much longer than with silicon alone. Without advances in nanoscale/molecular electronics, future computers would not be able to continue the current pace of development over the next twenty years. Molecular electronics can reduce the size of semiconductor rectifiers to the nanoscale by using single molecules as rectifiers. In addition, molecular electronics can also pave the way to single molecule sensing, which is an important part of the improvement of next-generation health care involving highly sensitive detection of toxic materials. Carbon-based nanomaterials such as carbon nanotubes, graphene, graphene nanoribbons, and carbonaceous molecular wires are the basis of carbon-based nanoelectronics. The 2009 edition of the International Technology Roadmap for Semiconductors (ITRS) recognizes the importance of carbon-based nanoelectronics, calling it an "emerging research information processing technology" and stating that it

"exhibits high potential and is maturing rapidly". The study of carbon-based nanomaterials is important for the eventual realization of their vast application potential. The research in this proposal will focus on the theoretical multi-scale modeling of nanoscale carbon-based materials such as nanotubes and graphene, addressing multiple different topics. Nanoscale rectification will be studied by examining various single molecule rectifiers connecting graphene or nanotube electrodes. Single molecule sensing will be studied by looking at functionalized graphene. The electronic structure of small diameter carbon nanotubes and small molecules that are of interest in molecular electronics will be examined with state-of-the-art methods that go beyond conventional density functional theory and can provide reliable predictions for experimentalists.

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**NBR: 276894** **ACRONYM: CANCER NANOMEDICINE** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2010-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Optimizing the Delivery of Nanomedicine to Solid Tumors

**Abstract:** Recent advances in nanotechnology have offered new hope for cancer detection, prevention, and treatment. While the enhanced permeability and retention effect has served as a key rationale for using nanoparticles to treat solid tumors, it does not enable uniform delivery of these particles to all regions of tumors in sufficient quantities. This heterogeneous distribution of therapeutics is a result of physiological barriers presented by the abnormal tumor vasculature and interstitial matrix. These barriers are in large part responsible for the modest survival benefit offered in many cases by clinically approved nanotherapeutics and must be overcome to realize the promise of nanomedicine in patients. More specifically, we need to determine the design criteria - the size, charge and configuration of various nanoparticle platforms - that optimize drug delivery to tumors. Here, I propose the development of a mathematical framework for the delivery of therapeutic nanoparticles to solid tumors. The model will account directly for the properties of the tumor micro-environment as well as for the properties (size, charge and configuration) of nanoparticles to predict their intratumoral distribution. I will specify the model to a human sarcoma and a human mammary carcinoma cell line for which a complete set of experimental data that characterize their micro-environment exists. Informed by these experimental measurements, I will use the mathematical model to construct "design maps" that will predict the nanoparticle properties that optimize intratumoral delivery, and thus the efficacy of cancer therapy. I will also employ the model to investigate if modifications in the tumor micro-environment with the use of anti-angiogenic and anti-fibrotic agents can improve the distribution of nanomedicine to solid tumors.

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**NBR: 276909** **ACRONYM: STEMTRACK** **EC FUND: 45000**

**DG:** REA **Call: FP7-PEOPLE-2010-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Engineering multifunctional superparamagnetic nanoparticles for long-term stem cell tracking

**Abstract:** Regenerative therapies involving stem cells are now beginning to realise their potential. Their use for bone marrow transplantation is already a reality and their potential for the treatment of other degenerative diseases is being studied in clinical trials throughout the world. One of the challenges in stem cell therapy is the possibility to monitor the fate of stem cells once they are transplanted to a patient. This is of relevance given the need of stem cells to localise at the target tissue only, as their migration to other parts of the body can lead to adverse consequences. In this project, we aim at developing the technology which is necessary for long-term stem cell tracking. This will be based on the use of magnetic resonance imaging (MRI) in combination with contrast agents based on superparamagnetic iron oxide nanoparticles (SPION). Although contrast agents based on SPION are commercially available, none offer the potential for long-term tracking of stem-cells. This limitation is based on the observations that after a few weeks, these contrast agents are not retained by stem cells anymore. Additionally, the SPION tend to be slowly degraded in the cells, limiting the time frame in which they can be used. As potential adverse effects caused by stem cells would likely arise in a time scale of months or years, the need for monitoring them for such periods is of importance. Here, we aim at developing new SPION with multifunctional surface properties that will address these limitations. SPION will be designed and synthesised in order to exhibit targeting moieties that allow their internalisation and long-term retention within stem cells. The developed SPION will be evaluated in vitro in order to assess their cytotoxicity, internalisation dynamics and retention. Nanoparticles which are shown to be suitable for long-term tracking via MRI in vitro will be finally studied in vivo by monitoring bone marrow stem cells implanted in mice displaying a renal injury.

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**NBR: 276921** **ACRONYM: SURFOPTIM** **EC FUND: 45000**

**DG:** REA **Call: FP7-PEOPLE-2010-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Complexity adapted theoretical studies on surface optimisation and reaction modelling

**Abstract:** The experimental techniques in the field of Surface Science are under constant upgrade according to the increasing complexity of the systems under study. Experimental developments would benefit from an improvement in their theoretical counterparts. I have wide expertise in the development of theoretical methods for the quantitative structural optimisation of surfaces using Low-Energy Electron Diffraction (LEED). My

background also covers the use of Density Functional Theory (DFT) methods applied to the study of atomic structure and physical chemistry in surfaces. In the proposed research, I intend to tackle problems integrating these two areas of expertise. I will describe electron multiple scattering in surfaces under different approximations, making the formalism efficient for nanoscaled adsorbates. On the other hand, typical strategies used in DFT codes often use steepest-descent-based methods to locate total energy minima (equilibrium structures) and saddle points (transition states), which tend to stagnate at local energy minima in the configuration space. I will apply global search methods within DFT, inspired by the electron diffraction techniques I am familiar with, as well as by other areas of knowledge where optimisation techniques are more developed. I will also make use of DFT calculations to study chemical processes on metallic surfaces, focusing in those aimed at the reduction of polluting gas emissions, such as reduction of NOx species. I will attempt a more realistic modelling of the catalytic properties of the surfaces, paying special attention to the effect of defects and surface partial oxidation on the reactivity. An accurate sampling of the configuration space will be key here.

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**NBR: 276933** **ACRONYM: LODIHYBRIDS** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2010-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Correlations and Proximity Effect in Low-Dimensional and Hybrid Structures

**Abstract:** Technological progress has lead to a huge growth in the field of mesoscopic physics over the past decade, and buzzwords like spintronics or quantum computing have created much excitement. At the origin of this development is the ongoing miniaturization and the ever increasing control over systems at the nanoscale. Central elements in understanding mesoscopic systems are the reduced dimensionality as well as the interplay of interactions and disorder. Luttinger liquid theory has been very successful in describing the low-energy properties of clean onedimensional systems. With the advent of more and more precise measurements, the question as to the limitations of Luttinger liquid physics has arisen only fairly recently. The proposed research explores (quasi-)onedimensional physics beyond the Luttinger liquid description, focusing on deviations from onedimensionality in interacting quantum wires and the interplay of interactions and disorder. Hybrid systems offer new ways of designing system functionality by combining materials with different, even antagonistic properties. A prime example are superconductor-ferromagnet systems where the incompatibility of the spin properties leads to a number of unusual phenomena. The proposed research explores correlations and dynamic (spin) effects in hybrid systems. Finally, ultracold atomic systems have opened a new window on interacting quantum systems. Since the first realization of Bose-Einstein condensation of a gas of bosonic atoms, ultracold atom physics has rapidly evolved. Pairing of fermions has been observed with the analogue of two spin states realized using two different hyperfine states. One of the most exciting features of these

recently discovered atomic paired-fermion superfluids is the tunability of the interactions via a magnetic field-induced Feshbach resonance. The proposal considers ultracold gases in an inhomogeneous magnetic field to explore aspects of (quasi-)onedimensional and hybrid systems.

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**NBR: 276960** **ACRONYM: FUNDNAMAT** **EC FUND: 45000**

**DG:** REA **Call: FP7-PEOPLE-2010-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Functional DNA-based nanomaterials using metal-mediated self-assembly processes

**Abstract:** This research project will focus on the development of conducting molecular architectures using self-assembly processes between specific DNA sequences and metal ions-derivatives. The concept is to use the interaction of specific metal ions towards precise DNA nucleobases. Novel synthetic metal complexes will be prepared carrying specific functional units capable of directing the formation of conducting polymers. These metal complexes will be organized at the nanoscale by interaction with particular DNA base-sequences through self-assembly processes. The project will also involve the preparation of complex DNA-based nanomaterial structures through a novel route which extends upon the well-established DNA origami concept using the unique properties of metal ions and their specificity to form metal-mediated DNA duplexes. The self-assembly properties of DNA and specific metal-ions will be explored for the construction of complex nanoscale architectures. Importantly, the original methodology proposed will be also employed for the incorporation of further functionality into DNA-based nanomaterials, since the properties of the metal-complexes can be tailored with different functional groups. Established synthetic methodologies will used for the synthesis of the metal-precursor compounds and these will be characterised using standard techniques to set up structural details, e.g. NMR, elemental analysis, ionized electrospray mass spectroscopy LC(IES-MS), spectroscopic (FTIR, UV-vis). The formation of conducting polymer nanomaterial will involve chemical oxidation or metal-coordination of the organized units along the DNA molecules. The resulting materials will be characterised using a range of spectroscopy techniques (FTIR, CD, UV-vis) as well as state-of-the-art scanning probe microscopy (AFM, EFM, STM). Finally, the conducting properties of the materials will be examined using a combination of 2-electrode devices and scanning probe methods.

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**NBR: 276980** **ACRONYM: COMPONLO** **EC FUND: 45000**

**DG:** REA **Call: FP7-PEOPLE-2010-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Polymer / metal nanoparticles composites with enhanced non-linear optical properties

**Abstract:** The boost development of pioneering optoelectronic devices creates the need for powerful non-linear optical materials. Recently, the combination of metal nanoparticles with carefully designed polymers pointed out that it is possible to create composite materials with orders of magnitudes enhanced non-linear optical activity. However, no systematic studies yet exist on the parameters that influence the composite's non-linear optical properties yet. In the presented project, the systematic study of those parameters is proposed. The implementation of the proposal involves the synthesis of well-designed polymers and metal nanoparticles as well as their combination in the form of thin films with the desired structural characteristics. Subsequently, the non-linear optical properties of the films will be measured and the results will be interpreted under the prism of the films' structural characteristics. A number of parameters is proposed to be elucidated, such as metal nanoparticles concentration, disposition and surface plasmon resonance, interaction between polymer and nanoparticles, film thickness, etc. The outcome of the project is expected to establish certain guidelines for the design of effective non-linear optical materials, suitable for advanced technologies.

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**NBR: 277014** **ACRONYM: SRPNICVD** **EC FUND: 75000**

**DG:** REA **Call: FP7-PEOPLE-2010-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Stimuli Responsive Polymer Nanotubes by Initiated Chemical Vapor Deposition

**Abstract:** One dimensional nanotubular structures have a wide range of applications due to their unique physical and chemical properties that are different from the bulk materials. Metal and semiconductor nanotubes are being used as sensors, optoelectronic devices or transistors. Furthermore, polymeric nanotubes have great potential as biomedical devices due to the biocompatible nature of the polymers used. However, they are not as widely studied due to the difficulty of fabricating the nanotubular structures using common thin film deposition techniques. In this research, we propose to use initiated Chemical Vapor Deposition (iCVD) to fabricate polymer nanotubes. iCVD technique has been shown to successfully deposit polymer thin films while keeping the chemical moieties of the monomers intact. Furthermore, the crosslinking density and the wall thickness of the nanotubes can easily be tuned using iCVD as opposed to other techniques, such as solution-based techniques where the polymer should be soluble. Our proposal aims to develop nanocarrier systems of polymer nanotubes for various potential applications. A wide range of stimuli responsive polymers (SRP) will be used to fabricate the nanotubes and the mechanical and response characteristics of these nanostructures as a function of crosslinking density will be explored. In the next stage, coaxial nanotubes with both layers made of SRPs will be fabricated and the effects of the interaction between the layers on the release mechanism will be studied. The results of these studies will help us better understand the dominant mechanisms during uptake

and release and thus enable us to fabricate the nanocarriers according to the response desired. Furthermore, these nanotubes with improved performance will have significant impact as drug delivery systems or sensors.

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**NBR: 277060** **ACRONYM: GENOTYPING NANOPORES** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2010-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Genotyping using solid-state nanopores and Pepetide Nucleic Acid markers â€“ a new tool for single-molecule molecular diagnostics

**Abstract:** The rapidly decreasing costs of DNA sequencing have made the genomic sequences from thousands of pathogens broadly accessible. The utilization of this new knowledge in clinical practice, however, critically depends on the availability of new analytical tools and techniques that could quickly and efficiently detect the presence of specific genomic variants of pathogens. Some recent examples include the outbreak of H1N1 (Swine flu) and HIV-AIDS. Current approaches rely on costly and time-consuming Polymerase Chain Reaction (PCR), to achieve the specificity and quantity required by standard means of detection. Here I propose to develop a radically low-cost, single-molecule, genotyping method based on nanopore sensing of Peptide Nucleic Acids (PNA) markers. This method is designed to yield an extremely low cost, single-molecule detection of viral infections. Nanopores are emerging single-molecule sensors, where an electrophoretic force threads DNA or RNA biopolymers, into a nanoscale aperture made in a thin film. The threading process uncoils the biopolymers, as they move from one side of the film to the other. Molecules entering the nanopore occlude some of the free ions in the solution from the pore volume, thus permitting real-time electrical detection of the local cross-section of the biopolymer. We propose to develop this method to permit the rapid detection of sequence-specific PNA markers, known to invade double-stranded DNA and form bulges at the points of invasion. We recently showed that PNAs can be detected using tiny solid-state nanopores. To transform this discovery into a robust analytical tool, extensive studies are now required to critically improve the nanopore fabrication, the signal over noise of the measurements, and the biomolecular strategies for efficient PNA invasion. Our studies will ultimately enable the development of low-cost, portable, and high-throughput devices for a broad range of genome based molecular diagnostics.

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**NBR: 277070** **ACRONYM: TEMPLATES** **EC FUND: 45000**

**DG:** REA **Call: FP7-PEOPLE-2010-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Molecular Host Templates for Nanoelectronic Functional Guests

**Abstract:** The TEMPLATES project aims at constructing highly organised lattices consisting of a nanoporous structural host template in which functional guest moieties can be accommodated, and to address these with electrochemical scanning probe techniques. The guest species are metal nanocrystals in the quantum confinement size range and redox molecules, both capable of active electronic function (switching, amplification, rectification) in an electrochemical environment. Our strategy focuses on electrolyte gating at electrified solid/liquid interfaces, which can address physical gates down to 1 nm by achieving strong electronic coupling, and allows the target "device" to function under ambient conditions. By varying the guest–guest distance, the electrolyte (including ionic liquids) and the operational conditions, we aim to demonstrate cooperative and gating medium effects, and long-term stability and functionality. The host–guest network could be used as high-density non-volatile memory or perform logic functions in nanoelectronic devices, and therefore has a high application potential. In addition to its challenging technical goals, the TEMPLATES project offers high potential of professional reintegration of the applicant. The research project capitalises on the results, scientific and complementary skills that the applicant acquired during the initial Marie Curie Fellowship, while maximising the benefits offered by the research environment of the new host institution, with a strong focus on knowledge transfer. In doing so, it is envisaged that the project will strongly catalyse the applicant's successful progress to an independent leading research position in the near future.

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**NBR: 277080** **ACRONYM: APEX-SPP** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2010-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Active and Passive Exploitation of Light at the Nanometre Scale

**Abstract:** Light and the various ways it interacts with matter is our primary means of sensing the world around us and it's no surprise that many technologies today are based on light. However, light cannot be imaged or focused to sizes below half its wavelength - known as the diffraction limit. To see smaller objects we must use shorter wavelengths. However, metals can shatter the diffraction limit of light and are now very promising for new technologies that expand the capabilities of computers and the internet and deliver new sensor technologies for healthcare, defense and security. We often take for granted just how strongly light interacts with metals. Electricity, oscillating at 50 Hz has a wavelength of thousands of kilometers, yet an electrical socket is no larger than a few centimeters; well below the diffraction limit! By structuring metal surfaces on the nanometre scale, this same phenomenon allows us to beat the diffraction limit in the visible spectrum. This approach has recently re-invigorated the study of optics at the nano-scale. I believe the paradigm of nano-optics is the capability to shrink light down to the length scales of molecular, solid state and atomic electronic states for the first time. With nano-optics, light-matter interactions are not only greatly strengthened but weak effects once difficult to detect are dramatically enhanced. If we can strengthen such

weak effects we can use them to realize new capabilities in optics. Last year, I reported in Nature that metal-based lasers can generate light below the diffraction limit and sustain it by amplification thus overcoming the inherent resistance of metals. While conventional lasers transmit light over large distances, it is the light inside these metal lasers that is unique. I want to use this light for new types of spectroscopy on the scale of individual molecules. Exploring optics at untouched length scales is an exciting opportunity with the potential for fundamentally new discoveries.

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**NBR: 277102** **ACRONYM: CSRR** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2010-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Correlative Super Resolution and Real-Time Imaging of Herpes Virus Infection

**Abstract:** Fluorescence imaging is a powerful technique that has transformed our understanding of biology. Recently, a number of techniques have been developed that overcome one of the fundamental limitations of fluorescence imaging, namely the diffraction limit. With these techniques, it is now possible to resolve sub-cellular architecture in multiple colors and 3D with unprecedented detail. However, the main limitation of these techniques has been the slow acquisition times making it difficult to study dynamic processes. Since biological samples are inherently highly dynamic, this limitation is a major hurdle that needs to be overcome. I will develop a correlative fluorescence imaging technique that combines the capabilities of super resolution and real-time imaging. With this correlative technique it will be possible to observe the dynamics of a biological sample in real-time and subsequently “freeze” the dynamics (by fixation or low temperature) at a time of interest to obtain a super resolution image. The dynamics can therefore be correlated with ultrastructural information, combining the capabilities of real-time and super resolution imaging. I will apply this correlative imaging technique to study infection mechanism of Herpes Simplex Virus (HSV). HSV is a medically important virus that infects neurons and epithelial cells. Besides the health hazards that it poses, HSV also has important implications in gene therapy. However, the details of HSV infection mechanism remain poorly understood. Since HSV infection involves dynamic interactions between virus particles and sub-cellular components, both of which are tens of nanometers in length scale, this is an ideal model system in which the correlative super resolution and real-time imaging technique will lead to important insights that were previously unattainable.

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**NBR: 277120** **ACRONYM: PROTEINATRP** **EC FUND: 45000**

**DG:** REA **Call: FP7-PEOPLE-2010-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Protein-based ATRP catalysts: From Nanoreactors to ATRPases

**Abstract:** Atom Transfer Radical Polymerization (ATRP) is the most successful and widely applied controlled radical polymerization process and has emerged as one of the most powerful synthetic techniques in polymer science. Chain termination reactions are suppressed and the growth of the chains proceeds in a controlled way. It allows precise control of the polymer's molecular weight, achieving a narrow molecular weight distribution and synthesis of polymers with complex molecular architectures, such as block copolymers. However, the major drawback of ATRP is the residual toxic copper ions found in the final polymer products. I propose to investigate protein-based catalysts for the mediation of ATRP. The methodology developed during my Marie Curie fellowship, the conjugation of appropriate ligands to defined sites on protein surfaces, will be used. ATRP catalysts will be obtained in which the active complex is encapsulated in a cage like protein nanoreactor, or where the catalyst is exposed on the surface of fluorescent proteins. The nanoreactors will be explored to synthesize individual amphiphilic block copolymer chains in a hydrophilic nanocompartment. This system allows studying the folding of individual amphiphilic block copolymer chains. On the other hand, fluorescent proteins will be explored as efficient means to remove copper from the polymerization solution, and to monitor such removal by observing the location of fluorescence. With this system, homo and block copolymers will be synthesized that are acceptable for application in biomedical and food-grade applications because of their low copper ion content. Last but not least, naturally occurring metalloproteins, such as hemoglobin, peroxidase and cytochromes, will be explored as ATRP catalysts in aqueous and in nonaqueous solutions. As these proteins are non-toxic and available in large quantities, they could become the ATRP catalysts of the future.

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**NBR: 277124** **ACRONYM: CHIRAL-MOF** **EC FUND: 75000**

**DG:** REA **Call: FP7-PEOPLE-2010-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Development of New Chiral Adsorbents for Enantioselective Separations

**Abstract:** Separation of chiral molecules plays an important role in the production of a wide array of pharmaceuticals, agricultural chemicals, and other molecules. Often these separations are carried out using chromatography, but the materials used in chiral chromatography columns have a number of disadvantages. In particular, they exhibit low capacity and it is difficult to tailor them because of poor control over the molecular-level architecture where chiral binding occurs. To overcome these problems, this project will develop new metal-organic frameworks (MOFs) featuring well controlled chiral environments. MOFs are a new class of nanoporous materials synthesized in a building-block approach from metal nodes and organic linkers with great potential for separations, catalysis, and other applications. The objectives of this multidisciplinary project are to • Develop and test the necessary tools for molecular simulation of

adsorption of chiral molecules in MOFs • Use molecular modeling to guide the synthesis of new MOFs for targeted separation of some important racemic mixtures • Collaborate with synthetic chemists to demonstrate experimentally that MOFs can perform enantioselective separations and test the results from simulations against experiments • Gain a better understanding of chiral recognition and the factors that affect selectivity in chiral MOFs. The proposed research will integrate solid state chemistry, adsorption fundamentals, and molecular modeling which forms the interface for achieving transformative advances in this field.

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**NBR: 277126** **ACRONYM: PROARGUS** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2010-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Protein Aggregation - a quantitative assessment

**Abstract:** Proteins aggregates are supramolecular ensembles capable to elicit significant biological responses and alter molecular reactions and quantitative, high throughput monitoring of the aggregation process is needed in high impact fields such as pharmacy and medicine. Very recent results show the possibility of ultrasensitive and conformation specific detection of proteins using sensors with Molecular Imprinted Polymers (MIP's). Formed in the presence of target analyte, these polymers retain the memory of analyte's shape. We propose to take advantage of the heightened and specific recognition properties of MIP's to build an integrated sensing platform for the simultaneous, specific detection of monomer, dimer and a higher protein aggregate. This device will circumvent the need for prior separation of protein species and will be employed to monitor the aggregation of two proteins, lyzosyme and calcitonin. The innovative platform we envisage consists in nanoarrays with layers of MIP's specific for monomer, dimer and a higher aggregate, deposited on the tips of gold nanopillars. Detection is based on the principle of impedance restoration when the "holes" in the polymer layer are filled by target protein species. Very sensitive detection of lyzosyme and calcitonin is anticipated and feasability of MIP micro arrays for monitoring the aggregation process will be assessed through a forced protein degradation study and rigorous validation against a reference method. The project takes a multidisciplinary approach to shed light on the kinetics of orientation of protein species at MIP "holes" and investigate non-specific adsorption, with additional knowledge to be gained through Atomic Force Microscopy, Electrochemical Methods and Surface Plasmon Resonance studies using state-of-the-art equipment available at host institution. Many answers to questions regarding aggregates themselves, their differences in shape and properties are expected to be provided in this way

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**NBR: 277152** **ACRONYM: GSL IN DEVELOPMENT** **EC FUND: 62500**

**DG:** REA **Call: FP7-PEOPLE-2010-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** The role of glycosphingolipids in development

**Abstract:** Glycosphingolipids have been implicated in the development of various human pathologies, such as cancer, obesity, diabetes or Alzheimer diseases. Their wide implication in cellular membrane architecture and cellular signaling network and metabolism has however made difficult the establishment of an integrated and accurate understanding of their role in vivo. The current proposal aims to understand such a role by taking advantage of a highly versatile system model, the Drosophila melanogaster. By combining sophisticated genetic and biochemical approaches with cutting edge biophysical strategies, such as FRET or FRAP technologies, this proposal intends to 1) determine how GSLs affect the dynamic organization of membranes at the nanoscale resolution in vivo, 2) study the GSL impact on cellular signaling and 3) polarity and finally 4) uncover some putative molecular regulators of GSL function in vivo. Preliminary work in Drosophila embryos allowed us to demonstrate that the absence of core GSLs in two related lethal mutants, egghead (egh) and brainiac (brn), leads to a surprisingly specific phenotype consisting in an increased number of proprioceptive organs. During the eclosion process, flies lacking core GSLs are unable to organize their movements and dies within the pupae case. Interestingly, Brn protein expression in brn flies using the UAS/GAL4 system in proprioception organs rescues their phenotype. We hence intend to take advantage of these rescue conditions to screen for molecular factors allowing to compensate the absence of core GSLs. Finally, the increased in proprioceptive organs being typically associated to an upregulation of the EGFR pathway, we aim to understand its genetic relationship of brn and egh mutations. This comprehensive characterization of the role of core GSLs in vivo will certainly constitute an important step in order to further evaluate the nature of their function in Drosophila models of human diseases in the near future.

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**NBR: 277179** **ACRONYM: QOFES** **EC FUND: 75000**

**DG:** REA **Call: FP7-PEOPLE-2010-RG** **Thema:** FP7-PEOPLE-2009-RG

**Title:** Quantum Optomechanics for Fundamental Experiments in Space

**Abstract:** Quantum theory has been confirmed to extreme accuracy in a vast variety of experiments over the last century. While most of these experiments have been limited to a microscopic scale, several milestones in demonstrating quantum effects for more and more massive objects have been achieved, in particular by experiments on the interference of large molecules. In the last few years, a new approach to test quantum physics with significantly more massive objects has emerged where the electromagnetic field is used to achieve control over massive mechanical resonators, eventually into the

quantum regime. In particular, quantum optomechanics deals with resonators that are coherently controlled via optical fields. Such systems allow for unprecedented levels of accuracy in the measurement of forces. Eventually, by preparing these massive resonators in non-classical states of motion, they may enable the investigation of quantum effects in a regime where gravitation becomes non-negligible. A limiting factor so far has been the coupling of the resonator to its environment. Using nanospheres levitated in optical trapping potentials, promises to overcome that limitation and will allow for high-precision measurements of gravitation as well as novel experiments on the frontier between quantum theory and the theory of relativity. Space provides an ideal environment for such experiments. Using a spacecraft like the one used in the LISA Pathfinder mission, it is possible to combine a micro-gravity environment, which allows for a much higher mass of the levitated spheres and reduces many sources of noise (e. g. seismic), with readily available optical space technology. This research proposal aims at designing possible experiments with levitated optomechanical resonators in space, testing the feasibility of these schemes in ground-based experiments, and investigating the prerequisites of fundamental optomechanical experiments in space.

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**NBR: 277588** **ACRONYM: SINOXYGEN** **EC FUND: 1338000**

**DG:** ERCEA **Call: ERC-2011-StG_20101014** **Thema:** ERC-SG-PE5

**Title:** Advancing the Green Chemistry of Singlet Oxygen and Applying it to Synthetic Challenges

**Abstract:** Novel synthetic methods are vital to the work of a host of key chemical disciplines; from new materials and nanotechnology to pharmaceuticals, practitioners constantly need cleaner, greener, milder and more efficient ways to synthesize their chosen targets. In this proposal, we seek to develop, and then apply to some very challenging scenarios, a set of particularly powerful and beyond the state-of-the-art new methods, using singlet oxygen, that will meet all these tough criteria. Singlet oxygen is a remarkable reagent; it is a natural, cheap, green and atom-efficient oxidant. It also makes an ideal initiator for cascade reaction sequences through which molecular complexity is enhanced very rapidly and effectively. With this chemistry protecting groups and toxic heavy metal oxidants, both normally associated with the construction of molecules rich in oxygen functionality, are not needed. In the projects described within this proposal, singlet oxygen will be manipulated to orchestrate a diverse range of cascade reaction sequences, and “super cascade” reaction sequences, by which complex polyoxygenated and polycyclic molecular architectures will be synthesized, from very simple and readily accessible furan precursors, in one-pot. Polyoxygenated-polycyclic motifs are common synthetic targets across a range of disciplines. In our case, we will focus research efforts towards bioactive natural products because these highly complex and intricate structures provide the best, and most challenging, testing grounds for any new set of chemical methods. The natural products chosen belong to the azaspiracid,

pinnatoxin/pteriatoxin, spirolide and pectentoxin families, respectively. We also hope to further promote the widespread application of these singlet oxygen-based chemical solutions to a host of problems by developing a prototype Continuous Flow Reactor that will facilitate large scale photooxygenations.

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**NBR: 277762** **ACRONYM: COLDNANO** **EC FUND: 1944000**

**DG:** ERCEA **Call: ERC-2011-StG_20101014** **Thema:** ERC-SG-ID1

**Title:** UltraCOLD ion and electron beams for NANOscience

**Abstract:** COLDNANO (UltraCOLD ion and electron beams for NANOscience), aspires to build novel ion and electron sources with superior performance in terms of brightness, energy spread and minimum achievable spot size. Such monochromatic, spatially focused and well controlled electron and ion beams are expected to open many research possibilities in material sciences, in surface investigations (imaging, lithography) and in semiconductor diagnostics. The proposed project intends to develop sources with the best beam quality ever produced and to assess them in some advanced surface science research domains. Laterally, I will develop expertise exchange with one Small and Medium Enterprise who will exploit industrial prototypes. The novel concept is to create ion and electron sources using advanced laser cooling techniques combined with the particular ionization properties of cold atoms. It would then be first time that “laser cooling” would lead to a real industrial development. A cesium magneto-optical trap will first be used. The atoms will then be excited by lasers and ionized in order to provide the electron source. The specific extraction optics for the electrons will be developed. This source will be compact and portable to be used for several applications such as Low Energy Electron Microscopy, functionalization of semi-conducting surfaces or high resolution Electron Energy Loss Spectrometry by coupling to a Scanning Transmission Electron Microscope. Based on the knowledge developed with the first experiment, a second ambitious xenon dual ion and electron beam machine will then be realized and used to study the scattering of ion and electron at low energy. Finally, I present a very innovative scheme to control the time, position and velocity of individual particles in the beams. Such a machine providing ions or electrons on demand would open the way for the “ultimate” resolution in time and space for surface analysis, lithography, microscopy or implantation.

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**NBR: 277784** **ACRONYM: NANOMOL** **EC FUND: 1446107**

**DG:** ERCEA **Call: ERC-2011-StG_20101014** **Thema:** ERC-SG-PE5

**Title:** From Nano Test Tube to Nano Reactor: Visualisation, Manipulation and Synthesis of Molecules at Nanoscale

**Abstract:** High aspect ratio (quasi-1D) nanostructures have potential to revolutionise the way we use, make and study molecules. This ambitious project is designed to enable characterisation and manipulation of molecules at a single-molecule level, visualisation of mechanisms of chemical reactions in real space and time, and synthesis of molecules within nano-sized containers. Understanding interactions of molecules with nanostructures of different types (nanofibres, nanotubes) and different chemical composition (carbon, bron nitride, titanium dioxide) forms a fundamental core of this project, as the 1D nanomaterials will serve as structural and functional bridges between the molecular world and the macro world. This project opens up new broad horizon for molecular disciplines, such as organic chemistry, molecular physics and the science of nanomaterials. Molecules possessing optical (polyaromatic hydrocarbons, complexes of transition metals and lanthanides), magnetic (single-molecule magnets, free radicals) or redox (metallocenes, molecular wires, tetrathiafulvalene) properties wired to 1D nanostructures will be delivered for next generation of electronic devices, harnessing functional properties of individual molecules for a variety of applications ranging from ultrasensors to quantum information processors. This project will help to establish a precise control of geometries and orientations of extended molecular arrays urgently needed for nano-device applications. Understanding of how molecules interact with 1D nanostructures and how they react with each other when confined within nano-reactors will give a new powerful set of tools to control the direction, selectivity and kinetics of chemical reactions. Methodology of molecular confinement at the nanoscale developed in this project will offer new opportunities for preparative synthetic chemistry of the XXI century leading to high-value isomerically and enantiomerically pure products that cannot be synthesised otherwise.

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**NBR: 277879** **ACRONYM: M&M´S** **EC FUND: 1495982**

**DG:** ERCEA **Call: ERC-2011-StG_20101014** **Thema:** ERC-SG-PE7

**Title:** New Paradigms for MEMS & NEMS Integration

**Abstract:** Micro- and nanoelectromechanical system (MEMS and NEMS) components are vital for many industrial and consumer products such as airbag systems in cars and motion controls in mobile phones, and many of these MEMS and NEMS enabled applications have a large impact on European industry and society. However, the potential of MEMS and NEMS is being critically hampered by their dependence on integrated circuit (IC) manufacturing technologies. Most micro- and nano-manufacturing methods have been developed by the IC industry and are characterized by highly standardized manufacturing processes that are adapted for extremely large production volumes of more than 10.000 wafers per month. In contrast, the vast majority of MEMS and NEMS

applications only demands production volumes of less than 100 wafers per month in combination with different non-standardized manufacturing and integration processes for each product. If a much wider variety of diverse and even low-volume MEMS and NEMS products shall be exploited, the semiconductor manufacturing paradigm has to be broken. In this project, we therefore will focus on frontier research on new paradigms for flexible and cost-efficient manufacturing and integration of MEMS and NEMS within three related research areas: (1) Wafer-Level Heterogeneous Integration for MEMS and NEMS, where we explore new and improved wafer-level heterogeneous integration technologies for MEMS and NEMS devices; (2) Integration of Materials into MEMS Using High-Speed Wire Bonding Tools, where we explore new ways of integrating various types of wire materials into MEMS devices; (3) Free-Form 3D Printing of Mono-Crystalline Silicon Micro- and Nanostructures, where we explore entirely novel ways of implementing mono-crystalline silicon MEMS and NEMS structures that can be arbitrarily shaped.

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**NBR: 277885** **ACRONYM: QD-CQED** **EC FUND: 1482000**

**DG:** ERCEA **Call: ERC-2011-StG_20101014** **Thema:** ERC-SG-PE3

**Title:** A quantum dot in a cavity: A solid state platform for quantum operations

**Abstract:** A quantum dot (QD) in a microcavity is an ideal single spin-single photon interface: the spin of a carrier trapped inside a QD can be used as a quantum bit and the coupling to photons can allow remote spin entanglement. A QD in a cavity can also generate single photons or entangled photon pairs, often referred to as flying quantum bit. Controlling the QD spontaneous emission is crucial to ensure optimal coupling of the photon and spin states. The present project relies on a unique and original technology we have developed which allows us to deterministically control the QD-cavity system. With this technique, we can fabricate a large number of identical coupled QD-cavity devices operating either in the weak or strong coupling regime. The potential of the technique has been proven by the fabrication of the brightest source of entangled photon pairs to date (Nature 2010). The objective of the present project is to build up a platform for basic quantum operations using QDs in cavities. The first aim is to develop highly efficient light emitting devices emitting indistinguishable single photons and entangled photon pairs. The mechanisms leading to quantum decoherence in QD based sources will be investigated. We will also explore a new generation of devices where QDs are coupled to plasmonic nano-antenna. The second objective is to implement basic quantum operations ranging from entanglement purification to quantum teleportation using QD based sources. The third objective of the project is to control the spin-photon interface. We first aim at demonstrating quantum non-demolition spin measurement through highly sensitive off-resonant Faraday rotation. We then aim at entangling two spins separated by macroscopic distances, using their controlled interaction with photons. This will be obtained either by making a single photon interact with two spin in

cavities or by interfering indistinguishable photons emitted by two independent charged QDs.

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**NBR: 277910** **ACRONYM: DIAMOND** **EC FUND: 1728576**

**DG:** ERCEA **Call: ERC-2011-StG_20101014** **Thema:** ERC-SG-PE4

**Title:** Discovery and Insight with Advanced Models Of Nanoscale Dimensions

**Abstract:** Generating knowledge about new materials and obtaining insight in their properties at the nanoscale level are highly relevant to the scientific objectives of the EU. Here, I propose to advance the current state of the art in atomistic modeling of complex systems. I aim at providing and establishing new tools that will allow for the description of large multi-component/multi-phase systems at experimental temperature and pressure with predictive power and controlled error. Generality and ease of use will be key. Building upon my experience, I have identified two clear needs that I will address. One need is a capable implementation, i.e. suitable for large condensed phase systems, of electronic structure theories that go beyond traditional DFT. Powerful linear scaling methods with excess accuracy are essential to validate, on the complex systems themselves, the use of DFT. The second need is an automatic approach for extracting empirical models from raw electronic structure data. Empirical methods are essential to perform simulations that are multiscale in time, space, and accuracy. This automatic approach must be able to generate models beyond the intuition and patience of an individual scientist using advanced optimization methods such as genetic algorithms or neural networks. Models must have a built-in estimate of their quality. The latter feature will allow for enhancing/correcting these empirical approaches automatically with first principles calculations whenever necessary. Massively parallel computing will be the enabling technology. In line with my track record, I will establish these new methods by demonstrating their potential through challenging applications. Example applications will be in diverse fields, including sustainable energy production, catalysis, environment and health. By making these tools freely and openly available to both academia and industry the benefit for the community as a whole will be significant.

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**NBR: 278023** **ACRONYM: DYNCORSYS** **EC FUND: 1493178**

**DG:** ERCEA **Call: ERC-2011-StG_20101014** **Thema:** ERC-SG-PE3

**Title:** Real-time dynamics of correlated many-body systems

**Abstract:** Strongly correlated materials exhibit some of the most remarkable phenonomena found in condensed matter systems. They typically involve many active degrees of freedom

(spin, charge, orbital), which leads to numerous competing states and complicated phase diagrams. A new perspective on correlated many-body systems is provided by the nonequilibrium dynamics, which is being explored in transport studies on nanostructures, pump-probe experiments on correlated solids, and in quench experiments on ultra-cold atomic gases. An advanced theoretical framework for the study of correlated lattice models, which can be adapted to nonequilibrium situations, is dynamical mean field theory (DMFT). One aim of this proposal is to develop "nonequilibrium DMFT" into a powerful tool for the simulation of excitation and relaxation processes in interacting many-body systems. The big challenge in these simulations is the calculation of the real-time evolution of a quantum impurity model. Recently developed real-time impurity solvers have, however, opened the door to a wide range of applications. We will improve the efficiency and flexibility of these methods and develop complementary approaches, which will extend the accessible parameter regimes. This machinery will be used to study correlated lattice models under nonequilibrium conditions. The ultimate goal is to explore and qualitatively understand the nonequilibrium properties of "real" materials with active spin, charge, orbital and lattice degrees of freedom. The ability to simulate the real-time dynamics of correlated many-body systems will be crucial for the interpretation of experiments and the discovery of correlation effects which manifest themselves only in the form of transient states. A proper understanding of the most basic nonequilibrium phenomena in correlated solids will help guide future experiments and hopefully lead to new technological applications such as ultra-fast switches or storage devices.

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**NBR: 278025** **ACRONYM: COMEDIA** **EC FUND: 1497000**

**DG:** ERCEA **Call: ERC-2011-StG_20101014** **Thema:** ERC-SG-PE2

**Title:** Complex Media Investigation with Adaptive Optics

**Abstract:** Wave propagation in complex (disordered) media stretches our knowledge to the limit in many different fields of physics. It has important applications in seismology, acoustics, radar, and condensed matter. It is a problem of large fundamental interest, notably for the study of Anderson localization. In optics, it is of great importance in photonic devices, such as photonic crystals, plasmonic structures or random lasers. It is also at the heart of many biomedical-imaging issues: scattering ultimately limits the depth and resolution of all imaging techniques. We have recently demonstrated that wavefront shaping –i.e. adaptive optics applied to complex media- is the tool of choice to match and address the huge complexity of this problem in optics. The COMEDIA project aims at developing a novel wavefront shaping toolbox, addressing both spatial and spectral degrees of freedom of light. Thanks to this toolbox, we plan to fulfill the following objectives: 1) A full spatiotemporal control of the optical field in a complex environment, 2) Breakthrough results in imaging and nano-optics, 3) Original answers to some of the most intriguing fundamental questions in mesoscopic physics.

**NBR: 278042** **ACRONYM: SADEL** **EC FUND: 4951792**

**DG:** RTD **Call: FP7-HEALTH-2011-two-stage** **Thema:** HEALTH.2011.1.4-3

**Title:** Scaffolds for alternative delivery

**Abstract:** The SME-based SADEL consortium intends to develop the first generation of oral bio-therapeutics tackling disease targets in the digestive tract, by making optimal use of the Nanofitin (Nf) protein scaffold. Nf based drugs will progress through routes not travelled by antibodies while interacting with targets not modulated by chemical compounds. Existing Nf hits against validated targets will progress to the preparation of Phase I Clinical trials in Ulcerative Colitis (UC). To achieve this, SADEL assembles a virtual biopharmaceutical company with SMEs (70%), academics, clinicians and pharma industry with all cutting-edge skills: production (including GMP), analytics, formulation, preclinical and clinical development, up to licensing. Nfs are small (optimal tissue penetration), exhibit strong resistance to pH and human intestinal fluids (long half-life in digestive track) and their high affinity implies low effective concentration. They also demonstrate strong potential for optimizing pharmacological properties, including reducing immunogenicity. The Nf based drugs will be administered orally, reducing the systemic exposure and avoiding the safety issues reported with systemic administration of antibodies. This requires large quantities of proteins for frequent administration. Nfs are produced in bacterial systems for which GMP-compliant processes are broadly adopted in the industry, with a low cost of goods. The resulting proteins will be formulated for optimal release at the sites of action. The project is designed to address unmet technical challenges while avoiding external risks beyond those related to the scaffold behaviour itself. All additional elements are chosen for documented validation, from targets to evaluation protocols. Achieving SADEL aims will solve unmet patient needs by providing affordable, safe, efficient products in a format raising comfort and compliance to treatment. It will also assess the therapeutic potential of the Nanofitin platform.

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**NBR: 278122** **ACRONYM: NANOETHICS 2011** **EC FUND: 107814**

**DG:** RTD **Call: FP7-Adhoc-2007-13** **Thema:** SiS

**Title:** Governance and ethics of nanosciences and nanotechnologies

**Abstract:** The main objective of the project is to raise awareness of policy makers, experts, scientists, representatives of industry, third sector and general public in regard to the Commission's Code of Conduct for responsible nanosciences and nanotechnologies

research as well as other developments in governance and ethics of such research. It should also inspire further discussion on these subjects on national and European level, and encourage actions of the EU Member States concerning development of national regulations in the area of responsible nanosciences and nanotechnologies research. The above mentioned objectives will be achieved through organization of the Polish Presidency conference "Governance and ethics of nanosciences and nanotechnologies" (Nanoethics 2011), follow-up activities and the overall promotion of the project. The conference will be organized in Warsaw on 20-21 October 2011. It will have a particular focus on the EC Code of Conduct for responsible nanosciences and nanotechnologies research, and activities of Member States concerning implementation of the Code will be presented and discussed. Stakeholders opinions will be heard as well. The conference will also be an occasion to present other initiatives in the field of governance and ethics of N&N research, and will contibute to dissemination of the results of the EU funded projects in this area. The event is planned for 200 participants. Among them there will be: the EC representatives, policy makers from the EU Member States, scientists, experts, representatives of industry and CSOs, delegates of national academies of sciences, and representatives of media and general public. The event will result in elaboration of the conference proceedings and the post-conference report that will contain summary of the event and recommendations concerning the EC Code of Conduct. Both publications will be broadly disseminated. The conference discussion will be continued on an on-line forum.

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**NBR: 278204** **ACRONYM: CELL-O-MATIC** **EC FUND: 5998788**

**DG:** RTD **Call: FP7-HEALTH-2011-two-stage** **Thema:** HEALTH.2011.1.1-1

**Title:** High Throughput Systematic Single Cell Genomics using Micro/Nano-Fluidic Chips for Extracting, Pre-analysing, Selecting and Preparing Sequence-ready DNA

**Abstract:** We propose a technology that will sit at the front-end of sequencing pipelines, present and future, and will significantly enhance the quality and throughput of DNA sequencing. Although much attention has been given to throughput/cost of the sequencing process itself, the same cannot be said for the preparation of samples. Identified bottlenecks are (1) sequencing technologies require days of upfront sample preparation which is further increased when sequencing selected parts of the genome; (2) genome assembly relies on computationally intensive comparisons to the reference genome because existing technologies produce short sequence reads; (3) it is difficult to begin with small amounts of sample material comprising micro-biopsies and single cells. The CELL-O-MATIC project will synergize efforts from SMEs, academics and large companies to address these bottlenecks by developing chip-based systems that process DNA from individual cells, ready for next generation high-throughput sequencing. Single cell analysis has numerous applications in systems biology but we will emphasize DNA isolation and sequencing from circulating tumor cells (CTC), which have a strong

prognostic value in cancer management. A second innovation will be to develop methods that enable up to whole chromosome lengths of DNA to be contiguously mapped using nanofluidics. The inclusion of nanofluidics makes the project particularly distinctive and introduces European SMEs to an area that so far has been the domain of US companies. A modular prototype comprising, a chip, fluid and thermal control, sonication and optical detection will be developed. Samples prepared using CELL-O-MATIC technology will be benchmarked in a high throughput environment with samples prepared by existing methods. Finally, the information obtained from the CELL-O-MATIC processed sample material will be validated for its utility as an aid to clinical decision making.

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**NBR: 278205** **ACRONYM: VDW-CMAT** **EC FUND: 1356999**

**DG:** ERCEA **Call: ERC-2011-StG_20101014** **Thema:** ERC-SG-PE4

**Title:** Van der Waals Interactions in Complex Materials

**Abstract:** Van der Waals (vdW) interactions are ubiquitous in nature, playing a major role in defining the structure, stability, and function for a wide variety of molecules and materials. VdW forces make the existence of molecular liquids and solids possible; they largely control protein-protein and drug-protein binding inside our bodies; they give geckos the ability to “defy gravity” attaching to walls and ceilings. An accurate first-principles description of vdW interactions is extremely challenging, since the vdW dispersion energy arises from the correlated motion of electrons and, in principle, requires many-electron quantum mechanics. Rapid increase in computer power and advances in modeling of vdW interactions have allowed to achieve “chemical accuracy” (1 kcal/mol) for binding between small organic molecules. However, the lack of accurate and efficient methods for large and complex systems hinders truly quantitative predictions of properties and functions of technologically relevant materials. We aim to construct and apply a systematic hierarchy of efficient methods for the modeling of vdW interactions with high accuracy and capacity to predict new phenomena in complex materials. Starting from quantum-mechanical first principles (adiabatic-connection fluctuation-dissipation theorem), we unify concepts from quantum chemistry (linear-response coupled-cluster and many-body perturbation theory), density-functional theory (ground-state electron-density response), and statistical mechanics (coupled-fluctuating-dipole model). Our final goal is to enable long time-scale molecular dynamics simulations with predictive power for large and complex systems of thousands of atoms. The project goes well beyond the presently possible applications and once successful will pave the road towards having a suite of first-principles modeling tools for a wide range of materials, such as biomolecules, nanostructures, solids, and organic/inorganic interfaces.

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**NBR: 278213** **ACRONYM: CHIRALMICROBOTS** **EC FUND: 1479760**

**DG:** ERCEA **Call: ERC-2011-StG_20101014** **Thema:** ERC-SG-PE4

**Title:** Chiral Nanostructured Surfaces and Colloidal Microbots

**Abstract:** From scientific publications to the popular media, there have been numerous speculations about wirelessly controlled microrobots (microbots) navigating the human body. Microbots have the potential to revolutionize analytics, targeted drug delivery, and microsurgery, but until now there has not been any untethered microscopic system that could be properly moved let alone controlled in fluidic environments. Using glancing angle (physical vapor deposition) we will grow billions of micron-sized colloidal screw-propellers on a wafer. These chiral mesoscopic screws can be magnetized and moved through solution under computer control. The screw-propellers resemble artificial flagella and are the only 'microbots' to date that can be fully controlled in solution at micron length scales. The proposed work will advance the fabrication so that active microbots can be applied in rheological measurements and analytics. We will use these novel probes in bio-microrheology with the potential to probe the viscoelastic properties of membranes and tissues, and to explore questions of micro-hydrodynamics. At the same time we will develop these structures as "colloidal molecules" and grow asymmetric mesoscopic particles with tailored shapes and properties. We propose experiments that allow the observation of fundamental effects, such as chiral Brownian motion, something that exist at the molecular scale, but has never been observed to date. Similarly, we will be able to demonstrate for the first time chiral separations based purely on physical fields. The proposed technical advances of the growth of nanostructured surfaces will at the same time permit wafer-scale 3-D nano-structuring for photonic and plasmonic applications, which we plan to demonstrate. We will develop a system for targeted drug delivery, study the interaction of swarms of microbots and devise techniques to control and image these swarms.

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**NBR: 278242** **ACRONYM: EXTENDFRET** **EC FUND: 1477942**

**DG:** ERCEA **Call: ERC-2011-StG_20101014** **Thema:** ERC-SG-PE4

**Title:** Extended fluorescence resonance energy transfer with plasmonic nanocircuits

**Abstract:** Förster fluorescence resonance energy transfer (FRET) is one of the most popular methods to measure distance, structure, association, and dynamics at the single molecule level. However, major challenges are limiting FRET in several fields of physical and analytical sciences: (i) a short distance range below 8 nm, (ii) a concentration range in the nanomolar regime, and (iii) generally weak detected signals. At the interface between physical chemistry and nano-optics, the proposal objective is to extend the

effectiveness of single molecule FRET using plasmonic nanocircuits to: (i) perform FRET on a range up to 20 nm, (ii) detect a single FRET pair in a solution of micromolar concentration, and (iii) improve the statistical distribution in FRET measurements. To meet its ambitious goals, the proposal introduces plasmonic nanocircuits to tailor the light-molecule interaction at the nanoscale. Energy transfer between donor and acceptor fluorophores is efficiently mediated through intense surface plasmon modes to extend the FRET distance range and improve the fluorescence signal. Moreover, the nanocircuits will be combined with recent innovations in biophotonics: stimulated emission of acceptor fluorescence, full dynamic analysis, and fluidic nanochannels. The scientific breakthroughs and project impacts will open new horizons for proteomics, enzymology, genomics and photonics. For elucidating molecular structure, the long range FRET will enable understanding the folding structure of large DNA or protein molecules. For assessing chemical reactions, achieving single molecule analysis at micromolar concentration is essential to monitor relevant kinetics, reveal sample heterogeneity, and detect rare and/or transient species. For analytical chemistry, nanocircuits are ideal for sensitive biosensing on a chip. For photonics, nanocircuits can realize key components for optical information processing at the nanoscale.

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**NBR: 278313** **ACRONYM: BIOMAGSCAR** **EC FUND: 5299478**

**DG:** RTD **Call: FP7-HEALTH-2011-two-stage** **Thema:** HEALTH.2011.1.4-2

**Title:** Biodegradable Magnetic Stent for Coronary Artery Luminal Regeneration

**Abstract:** By 2010 1.5 million stents per year will be deployed in Europe. Although outcome for patients has improved, stents still fail because of the occurrence of restenosis and thrombosis at the site of implantation. While drug eluting stents have helped to reduce the problem of restenosis, neointimal proliferation causing restenosis can still occur. Additional concerns exist regarding drug eluting stents as there appears to be a small but real increase in late and very late stent thrombosis, particularly after discontinuation of antiplatelet therapy. The novel concept we propose is use of a biodegradable magnetised stent (BMS) to deliver a novel biological therapy offering regenerative medicine solutions to the coronary artery vessel wall. Specifically we will develop the stent technology as a platform to attract autologous progenitor cells tagged in vitro with iron nanoparticles. Once deployed, the cells will be attracted to the already implanted BMS and proliferate to form a new endothelium. We will also use over-expression of the NRP1 gene in the artery wall where it will dimerise with NRP1 receptors on the deployed cells. The NRP1 gene will be transfected by adenovirus delivered from the wall of the BMS. Over time the BMS will undergo a predictable degradation to leave a wholly biological artery through regeneration of native tissues. Currently, about 12,000 European Citizens a year suffer from late in-stent thrombosis and 120,000 from restenosis. With the knowledge and technologies developed through the BIOMAGSCAR project we aim to halve this number of patients and save 66,000 people from

unnecessary suffering, saving the European healthcare system €275 million p.a. in direct costs, only 10% of the total associated costs. Our consortium includes a vascular disease therapy company, a stent research and manufacturing company, four universities and a specialist in innovative technology investment, all of whom believe our technology will dramatically change this field.

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**NBR: 278320** **ACRONYM: OPTOMECH** **EC FUND: 1499000**

**DG:** ERCEA **Call: ERC-2011-StG_20101014** **Thema:** ERC-SG-PE3

**Title:** Theory of optomechanical circuits

**Abstract:** The interaction between light and mechanical motion in nanostructures has become a research topic with significant impact and promise recently. This rapidly developing area at the intersection between nanophysics and quantum optics is also known as “cavity optomechanics”. Fundamental investigations in quantum physics and possible applications like ultrasensitive detection of small displacements, forces and masses drive this field. By now, the basic features have been demonstrated in various experiments worldwide during the past five years. These include displacement detection with precisions down to the standard quantum limit, nonlinear dynamics in optomechanical self-oscillations, and cavity-assisted optomechanical laser-cooling of vibrational modes. The concepts involved are general enough to be applicable to a large variety of different setups, extending to variants such as nanomechanical resonators in superconducting microwave circuits and clouds of cold atoms. It is now time to put these basic elements together and investigate the design of structures containing multiple interacting optical and mechanical modes. These could be used to form optomechanical “circuits” or “arrays”. Recently demonstrated nanofabricated photonic-phononic crystal structures provide one essential platform in which to realize these ideas. On the applied side, integrated optomechanical circuits might combine several functions, such as detection, amplification and general signal processing, or contribute to quantum information processing by converting information to and from the light field. On the fundamental side, arrays of optomechanical elements could be used to study the collective many-body dynamics (both classical and quantum) of these novel nonequilibrium systems. We propose to explore theoretically these possibilities, providing a guide-line for experiments and thereby unlocking the potential of such devices.

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**NBR: 278364** **ACRONYM: PHOXY** **EC FUND: 1498000**

**DG:** ERCEA **Call: ERC-2011-StG_20101014** **Thema:** ERC-SG-PE10

**Title:** Phosphorus dynamics in low-oxygen marine systems: quantifying the nutrient-climate connection in Earthâ€™s past, present and future

**Abstract:** Phosphorus (P) is a key and often limiting nutrient for phytoplankton in the ocean. A strong positive feedback exists between marine P availability, primary production and ocean anoxia: increased production leads to ocean anoxia, which, in turn, decreases the burial efficiency of P in sediments and therefore increases the availability of P and production in the ocean. This feedback likely plays an important role in the present-day expansion of low-oxygen waters ("dead zones") in coastal systems worldwide. Moreover, it contributed to the development of global scale anoxia in ancient oceans. Critically, however, the responsible mechanisms for the changes in P burial in anoxic sediments are poorly understood because of the lack of chemical tools to directly characterize sediment P. I propose to develop new methods to quantify and reconstruct P dynamics in low-oxygen marine systems and the link with carbon cycling in Earth's present and past. These methods are based on the novel application of state-of-the-art geochemical analysis techniques to determine the burial forms of mineral-P within their spatial context in modern sediments. The new analysis techniques include nano-scale secondary ion mass spectrometry (nanoSIMS), synchotron-based scanning transmission X-ray microscopy (STXM) and laser ablation-inductively coupled plasma-mass spectrometry (LA-ICP-MS). I will use the knowledge obtained for modern sediments to interpret sediment records of P for periods of rapid and extreme climate change in Earth's history. Using various biogeochemical models developed in my research group, I will elucidate and quantify the role of variations in the marine P cycle in the development of low-oxygen conditions and climate change. This information is crucial for our ability to predict the consequences of anthropogenically-enhanced inputs of nutrients to the oceans combined with global warming.

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**NBR: 278402** **ACRONYM: NOVO** **EC FUND: 2971045**

**DG:** RTD **Call: FP7-HEALTH-2011-two-stage** **Thema:** HEALTH.2011.2.3.1-5

**Title:** Novel approaches for prevention and degeneration of pathogenic bacteria biofilms formed on medical devices e.g. catheters

**Abstract:** Biofilms are bacterial communities encased in a self-produced hydrated polymeric matrix. An important characteristic of microbial biofilms is their innate resistance to the immune system and susceptibility to antibiotics. This resistance has made microbial biofilms a common cause of medical infections, and difficult-to-treat infections caused by colonized foreign bodies. The NOVO project aims at developing novel approaches to prevent and/or degrade biofilms on catheters elongating their usage in humans up to 10 days. Two complementary approaches for biofilm prophylaxis will be developed: A. Ultrasonic coating of Inorganic antibiofouling agents (process developed by partner BIU) based on a single step sonochemical process to: a) Produce metal fluorides or metal

oxides (e.g. MgF2, ZnO) nanoparticles (NPs) and simultaneously b) Impregnate them as antibacterial factors on the catheters. c) Co-coating with bio-inert polymer layers (containing highly hydrophilic antifouling polyethylene glycol, zwitterionic moieties or sugar-groups) grafted onto NPs of adjusted size to the size of MgF2/ZnO NPs or directly onto MgF2/ZnO NPs; to form a hydrogel layer for the protection of the MgF2/ZnO antibiofouling activity. B. Bio/organic antibiofouling activation: 1) Novel coating for catheters based on radical catalyzed polymers to yield anti-bacterial activity. An enzymatic reaction will be applied on the phenolic compounds to generate phenolic radicals to be further polymerized on the catheter surface as an antibiofilm agent. 2) Develop and engineer Cellobiose Dehydrogenases (CDH) that actively oxidizes and degrades biofilms polysaccharides concomitantly producing stoichiometrically H2O2 as antibacterial agent. The enzymes will be coated on the catheters via a lubricant or by the Ultrasonic (US) process after their immobilization. Some novel CDH representatives already show very low activity on glucose which should be removed by further genetic engineering.

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**NBR: 278428** **ACRONYM: TERAGAN** **EC FUND: 1627236**

**DG:** ERCEA **Call: ERC-2011-StG_20101014** **Thema:** ERC-SG-PE7

**Title:** GaN Quantum Devices for T-Ray Sources

**Abstract:** T-rays, often called terahertz radiation or submillimeter waves, are loosely defined as the wavelengths from 30 µm to 1,000 µm, or the frequencies from 10 THz to 300 GHz. This non-ionizing radiation appears as a harmless alternative to x-rays in medical, biological and security screening. Current solutions in terms of coherent sources of T-rays either require cryogenic temperatures or are relatively bulky equipments based on optically-pumped materials. The solid-state recourse consisting of GaAs-based quantum cascade lasers presents an intrinsic limitation in operation temperature: The low energy of the longitudinal-optical (LO) phonon in arsenide compounds hinders laser emission beyond 180 K at 4 THz, and forces operation below the liquid nitrogen temperature (< 70 K) for frequencies below 1 THz. Overcoming this limitation requires a technology revolution through introduction of a new material system. This project aims at exploring a novel semiconductor technology for high-performance photonic devices operating in the T-ray spectral region. The advanced materials that we will investigate consist of nitride-based [GaN/Al(Ga,In)N] superlattices and nanowires, where we can profit from unique properties of III-nitride semiconductors, namely the large LO-phonon energy and the strong electron-phonon interaction. Our target is to adapt the quantum cascade design and fabrication technology to these new materials, characterized by intense internal polarization fields. Our project aims at pushing intersubband transitions in this material family to unprecendently long wavelengths, in other to cover the whole T-ray spectral gap with coherent solid-state sources operating at room temperature and above.

**NBR: 278510** **ACRONYM: VORTEX** **EC FUND: 1458300**

**DG:** ERCEA **Call: ERC-2011-StG_20101014** **Thema:** ERC-SG-PE3

**Title:** Exploring electron vortex beams

**Abstract:** In this project I will exploit new possibilities opened up by the recent succesful demonstration of our ability to create electron vortex beams in a transmission electron microscope. Electron vortex beams carry a helical phase and angular momentum around their propagation axis. They form the counterpart of optical vortex beams that were invented almost 20 years ago and have lead to many exciting new applications in optics. In preliminary experiments with electron vortices I have demonstrated (Verbeeck et al. Nature, 467,301 (2010)) their usefulness for magnetic state mapping. This property makes them very desirable for solid state physics and materials science since no other tool exists that can map the local magnetisation inside materials with atomic scale resolution. We aim to develop atomic resolution magnetic state mapping and apply it to gain insight in spintronics devices as well as in topological insulators. We will follow two routes to this end, one using the combination of electron vortex beams and electron energy loss spectroscopy (EELS) and another making use of the Aharanov Bohm effect in elastic scattering. Preliminary experiments proof that both routes are feasible and a wealth of interesting physics is ready to be explored. We will also explore the potential of electron vortex beams to manipulate nanoparticles and transfer angular momentum from the electron beam to these particles. This would open up the road to assemble and create nanoscale devices and to study the fundamental laws that govern the interaction between vortex beams and particles with different physical properties. I believe that this highly creative and innovative idea, combined with access to a state of the art transmission electron microscope and a young PI with a proven track record is combined into a project proposal entirely in the spirit of the ERC starting grants.

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**NBR: 278516** **ACRONYM: 2DNANOCAPS** **EC FUND: 1501296**

**DG:** ERCEA **Call: ERC-2011-StG_20101014** **Thema:** ERC-SG-PE8

**Title:** Next Generation of 2D-Nanomaterials: Enabling Supercapacitor Development

**Abstract:** Climate change and the decreasing availability of fossil fuels require society to move towards sustainable and renewable resources. 2DNanoCaps will focus on electrochemical energy storage, specifically supercapacitors. In terms of performance supercapacitors fill up the gap between batteries and the classical capacitors. Whereas batteries possess a high energy density but low power density, supercapacitors possess

high power density but low energy density. Efforts are currently dedicated to move supercapacitors towards high energy density and high power density performance. Improvements have been achieved in the last few years due to the use of new electrode nanomaterials and the design of new hybrid faradic/capacitive systems. We recognize, however, that we are reaching a newer limit beyond which we will only see small incremental improvements. The main reason for this being the intrinsic difficulty in handling and processing materials at the nano-scale and the lack of communication across different scientific disciplines. I plan to use a multidisciplinary approach, where novel nanomaterials, existing knowledge on nano-scale processing and established expertise in device fabrication and testing will be brought together to focus on creating more efficient supercapacitor technologies. 2DNanoCaps will exploit liquid phase exfoliated two-dimensional nanomaterials such as transition metal oxides, layered metal chalcogenides and graphene as electrode materials. Electrodes will be ultra-thin (capacitance and thickness of the electrodes are inversely proportional), conductive, with high dielectric constants. Intercalation of ions between the assembled 2D flakes will be also achievable, providing pseudo-capacitance. The research here proposed will be initially based on fundamental laboratory studies, recognising that this holds the key to achieving step-change in supercapacitors, but also includes scaling-up and hybridisation as final objectives.

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**NBR: 278530** **ACRONYM: AFFIRM** **EC FUND: 1468986**

**DG:** ERCEA **Call: ERC-2011-StG_20101014** **Thema:** ERC-SG-PE8

**Title:** Analysis of Biofilm Mediated Fouling of Nanofiltration Membranes

**Abstract:** 1.2 billion people worldwide lack access to safe drinking water. Drinking water quality is threatened by newly emerging organic micro-pollutants (pesticides, pharmaceuticals, industrial chemicals) in source waters. Nanofiltration is a technology that is expected to play a key role in future water treatment processes due to its effectiveness in removal of micropollutants. However, the loss of membrane flux due to fouling is one of the main impediments in the development of membrane processes for use in drinking water treatment. Currently there is a wholly inadequate mechanistic understanding of the role of biofilm on the fouling of nanofiltration membranes. Applying techniques including confocal microscopy, force spectroscopy, and infrared spectroscopy using an experimental programme informed by a technique known as scale-down together with mathematical modelling, it is confidently expected that significant advances will be gained in the mechanistic understanding of nanofiltration biofouling. The specific objectives are 1. How is the rate of formation and extent of such biofilms influenced by the biological response to the local microenvironment? 2 Elucidate the effect of extracellular polysaccharide substances on physical properties, composition and structure of these biofilms. 3: Investigate mechanisms to enhance biofilm removal by a physical detachment process complemented by techniques that alter biofilm material

properties. A more fundamental insight into the mechanisms of nanofiltration operation will help in further development of this treatment method in future water treatment processes.

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**NBR: 278698** **ACRONYM: PRECISE-NANO** **EC FUND: 1494447**

**DG:** ERCEA **Call: ERC-2011-StG_20101014** **Thema:** ERC-SG-PE3

**Title:** Atomically precise nanoelectronic materials

**Abstract:** The current devices used in electronics have reached nanometre dimensions where the precise nature and location of every atom matters. To further drive the development of existing technologies and to test proposals for next generation nanoelectronics, we need tools that allow structural and electronic characterization of materials down to the atomic scale. We need to be able to measure the position and nature of the atoms, as well as the local density of electronic states at a specific energy, the charge distribution, and atomic scale magnetic properties. In addition, we need methods that allow controlled manipulation of the relevant atomic-scale details of the active region of the material, where we could pick and place atoms or molecules and create vacancies at pre-defined locations. The goal of this project is to develop such tools and apply them to three different materials systems of enormous current interest: nanostructured graphene, molecular networks and topological insulators. Progress towards using these materials in real life electronic applications is currently limited by the restricted experimental handle of their structure at the atomic scale: for example, edge structure in graphene nanostructures and contacts in molecular devices. I will use scanning probe techniques to fabricate nanoelectronic devices of atomically precise structure and explore the possibilities offered by well-defined nanostructures and spatially controlled charge and spin-doping.

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**NBR: 278779** **ACRONYM: NANO@ENERGY** **EC FUND: 1500000**

**DG:** ERCEA **Call: ERC-2011-StG_20101014** **Thema:** ERC-SG-PE5

**Title:** Novel Design of Nanostructures for Renewable Energy: Fundamental Questions and Advanced Applications"

**Abstract:** Photovoltaics and liquid fuels are poised as major contributors to the global energy market, promising cleaner, renewable sources of energy than fossil fuels. However, the technologies required to make this possibility a reality are limited by their high cost per kWh, and current share of photovoltaics and liquid fuels in the energy market is thus extremely small. One method of reducing the costs of photovoltaics lies in the use of

semiconductor nanocrystals to absorb and convert solar photon energy to usable electricity and liquid fuel. Among the advantages of a nanocrystal-based design for photovoltaics are the requirement for thinner absorbing layers, the less energy-intensive refining processes, and their scalability with respect to photovoltaic production. To address these challenges, I plan to initiate a multidisciplinary research project that comprises three separate, but interrelated and complementary, parts that will be conducted in parallel. The first and the main part will be the preparation of novel hybrid nanostructures that have potential for PV and fuel cells applications. The second will focus on a systematic study of the fundamental processes of charge dynamics in the nanoscale regime. The materials and knowledge generated can then be applied in the third part of the project—development of PV and photoelectrochemical devices with scale-up potential for large-scale solar energy exploitation, and examination of benchmark properties (overall efficiency, I V characteristics, external quantum efficiency, hydrogen and liquid fuel production) of our new hybrid materials and devices. These properties will be used as feedback for the synthesis of more complex hybrid structures and for improving our device assembly methods and the choice of materials and/or composites for the devices.

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**NBR: 278793** **ACRONYM: MEVIC** **EC FUND: 1643736**

**DG:** ERCEA **Call: ERC-2011-StG_20101014** **Thema:** ERC-SG-PE5

**Title:** Molecular engineering of virus-like carriers

**Abstract:** In the last 5 years I have been working on the study of nanoscopic vesicles formed by the assembly in water of amphiphilic block copolymers. These polymer vesicles also known as polymersomes can be designed with size, topology and morphology similar to natural viruses. The synthetic nature of copolymers allows the design of interfaces with various classes of biochemically-active functional groups. This, in combination with precise control over the molecular architecture, determines the degree of order in self-organizing polymeric materials. Such bio-inspired 'bottom-up' supramolecular design principles can offer outstanding advantages in engineering structures at a molecular level, using the same long–studied principles of biological molecules. It is self-evident that the highly biocompatible nature of these new amphiphilic copolymer assemblies augurs well for biomedical applications. Indeed, related polymeric micelles and vesicles have already been reported and studied as delivery systems for drugs, gene, and image contrast agents. Herein I propose to engineer new generations of polymersomes whose size, topology, surface chemistry is exquisitely controlled by supramolecular interactions with the aim to control their bioactivity and explore new ways to target specific biological sites via multi-fictionalisation and steric controlled binding. This will be achieved by a balanced combination of novel physico-chemical techniques with tailor-made biological evaluation based on state-of-the-art cell culture methods as well as in vitro and in vivo high content screening. My long-term aim is to set-up new design

principles for nanoparticles for biomedical applications together with a thorough biomedical fast screening that will enable safe and fast translation into the clinic as well as benchmarking nanotoxicological methodologies.

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**NBR: 278801** **ACRONYM: ECNANO** **EC FUND: 1500000**

**DG:** ERCEA **Call: ERC-2011-StG_20101014** **Thema:** ERC-SG-PE4

**Title:** Electrochemistry in fluidic nanodevices: From fundamentals to integrated sensor platforms

**Abstract:** I propose to explore the frontiers of electrochemistry at the nanometer scale by developing new experimental approaches based on lithographically fabricated fluidic nanodevices. This will allow groundbreaking experiments on a broad range of fundamental topics including double layer structure, screening in ionic liquids, nanoscale hydrodynamics and the dielectric response of single macromolecules. It will also lay the foundations for new analytical techniques based on electrochemical single molecule recognition and targeted at integration with state-of-the-art electronics on a single chip. The latter combination could potentially bring about a revolution in (bio)sensing technology on a scale comparable to those which have already taken place in computing and communications. My first focus will be on nanofabricating sub-femtolitre channels and chambers in which single or small numbers of redox-active molecules can be detected and manipulated using electrochemistry at pairs of embedded electrodes. Simultaneously, I will explore the capabilities electrochemical impedance spectroscopy using nanoelectrodes at frequencies up to 200 MHz. Such a combination of ultra-short length scales and high frequencies has heretofore remained inaccessible and will be made possible here by using electrodes that form an intrinsic part of an integrated detection circuit. This research has a truly exploratory character, as few investigators so far have attempted to combine nanofluidics, modern microelectronics and electrochemistry. Doing so will test our microscopic understanding of electrochemical processes, enable new classes of experiments, and push the limits of electrochemistry as an analytical method. There is thus a high likelihood that further new concepts and applications will emerge over the course of this multidisciplinary program.

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**NBR: 278860** **ACRONYM: NANOFORCELLS** **EC FUND: 1492854**

**DG:** ERCEA **Call: ERC-2011-StG_20101014** **Thema:** ERC-SG-PE4

**Title:** Development of a nanomechanical tool-box for the investigation of cell mechanics

**Abstract:** The fact that biophysical and biomechanical properties of cells and subcellular structure influence and are influenced by onset and progression of human diseases is now attracting the physiologists attention. This opens up new routes for disease diagnosis and treatment. The first traditional way to discover a tumor was by palpation, such as sweetness in urine was indicative of diabetes. Nowadays, the biochemical search for diagnosis markers has experienced amazing advancements, while the physical cues have remained almost forgotten; this is mainly due to a lack of powerful tools able to unravel the mechanics of individual cells. This proposal aims to develop a set of tools and demonstrate their potential for the throughout study of individual cell mechanics and sub-cellular structures. The proposed tools will provide the route to develop mechanical and physical assays to extract the elastic and viscoelastic deformability of f.e. cancer cells as compared to healthy cells, providing with mechanical biomarkers for diagnosis. NANOFORCELLS proposes an innovative approach combining optical interferometry together with advanced nanomechanical systems and AFM local characterization. This mechanical lab for cells will provide new knowledge that can not be attained today with present technologies. Also, the proposed nanomechanical devices of this project will provide not only a direct measurement for single cell rigidity but the capability for parallel measurement of hundreds of individual cells per minute, opening the route for portable tests that could prove very general to determine the health status of cells from blood samples. Also, interaction of cell with the environment can be studied in real time and thus the devices will provide tools for the study of drug effects and drug delivery vehicles, or for the assessment of the toxicity of nanoparticles.

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**NBR: 278912** **ACRONYM: PHOTOSI** **EC FUND: 1182606**

**DG:** ERCEA **Call: ERC-2011-StG_20101014** **Thema:** ERC-SG-PE5

**Title:** Silicon nanocrystals coated by photoactive molecules: a new class of organic-inorganic hybrid materials for solar energy conversion

**Abstract:** Silicon nanocrystals (SiNCs) have gained much attention in the last few years because of their remarkable optical and electronic properties, compared to bulk silicon. These unique properties are due to quantum confinement effects and are thus strongly dependent on the nanocrystal size, shape, surface functionalization and presence of defects. The aim of the present project is the coupling of SiNCs with photo- and electroactive molecules or multicomponent systems, like dendrons, to build up a new class of hybrid materials to be employed in the field of light-to-electrical energy conversion (solar cells). SiNCs possess several advantages with respect to more commonly employed, quantum dots, which usually contain toxic and rare metals like lead, cadmium, indium, selenium: a) silicon is abundant, easily available and essentially non toxic; b) silicon can form covalent bonds with carbon, thereby offering the possibility of integrating inorganic and organic components in a robust structure; c) absorption and emission can be tuned across the entire visible spectrum from a single

material, upon changing the nanocrystal dimension. This project will address the understanding of the fundamental photophysical and electrochemical properties of SiNCs, and their electronic interactions with the functional coating units. Taking advantage of the acquired knowledge, the project will then be devoted to the implementation of these hybrid materials as light-harvesting and charge transport components in photoelectrochemical cells. PhotoSi is expected to lead to solar cells with high efficiency (superior electronic properties of the hybrid material), low cost (the amount of the nanostructured material is significantly reduced compared to conventional Si cells), and low environmental impact (Si is essentially non toxic, and new less-energy demanding synthetic methodologies will be explored).

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**NBR: 279004** **ACRONYM: DROEMU** **EC FUND: 1170923**

**DG:** ERCEA **Call: ERC-2011-StG_20101014** **Thema:** ERC-SG-PE3

**Title:** DROPLETS AND EMULSIONS: DYNAMICS AND RHEOLOGY

**Abstract:** The applications of micro- and nanofluidics are now numerous, including lab-on-chip systems based upon micro-manipulation of discrete droplets, emulsions of interest in food and medical industries (drug delivery), analytical separation techniques of biomolecules, such as proteins and DNA, and facile handling of mass-limited samples. The problems involved contain diverse nano- and microstructures with a variety of lifetimes, touching atomistic scales (contact lines, thin films), mesoscopic collective behaviour (emulsions, glassy, soft-jammed systems) and hydrodynamical spatio-temporal evolutions (droplets and interface dynamics) with complex rheology and strong non-equilibrium properties. The interplay of the dynamics at the different scales involved still remains to be fully understood. The fundamental research I address in this project aims to set up the unified framework for the characterization and modelling of interfaces in confined geometries by means of an innovative micro- and nanofluidic numerical platform. The main challenging and ambitious questions I intend to address in my project are: How the stability of micro- and nanodroplets is affected by thermal gradients? Or by boundary corrugation and modulated wettability? Or by complex rheological properties of the dispersed and/or continuous phases? How these effects can be tuned to design new optimal devices for emulsions production? What are the rheological properties of these new soft materials? How confinement in small structures changes the bulk emulsion properties? What is the molecular-hydrodynamical mechanism at the origin of contact line slippage? How to realistically model the fluid-particle interactions on the molecular scale? The strength of the project lies in an innovative and state-of-the-art numerical approach, based on mesoscopic Lattice Boltzmann Models, coupled to microscopic molecular physics, supported by theoretical modelling, lubrication theory and experimental validation.

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**NBR: 279248** **ACRONYM: PHAROS** **EC FUND: 1496400**

**DG:** ERCEA **Call: ERC-2011-StG_20101014** **Thema:** ERC-SG-PE3

**Title:** Guiding Light through Disorder in Adaptive Photonic Resonator Arrays

**Abstract:** Planar photonic crystals are dielectric nanostructures that are pursued worldwide as a platform for integrated nanophotonic circuits. Such circuits will process signals coded in light and will consist of thousands of basic components such as resonant nanocavities. At present, unavoidable nanometer-scale disorder makes such large-scale integration impossible. Disorder causes the resonances of the nanocavities to shift randomly, resulting in Anderson localization, an interference effect that blocks the propagation of light. Anderson localization – predicted in 1958 by Nobel Prize winner Philip Anderson – is an intriguing scientific phenomenon as well as a serious threat to applications. I propose to create adaptive nanophotonic systems. In these systems, I will use a spatially modulated light beam to modify the resonance frequency of each individual nanocavity. After adaptive tuning, the spatially structured light exactly counteracts the disorder and guides signals safely through the nanophotonic circuit. Effectively the signals will propagate in a perfect nanophotonic structure. As a second main innovation, I will employ an ultrafast structured light beam to write new, ordered and functional patterns into the circuit. This transformational technology will enable applications wherein optical circuits become fully programmable. The circuit will be modified dynamically in less time than that needed for a photon to pass through it. Spatial light modulators will enable us to address and control thousands of individual nanophotonic components. Our dynamic and adaptive nanophotonic system will enable new technology, such as dynamically tunable delay lines, and open up new regimes of light propagation: the crossover regime of Anderson localization, ultraslow light that propagates scarcely faster than sound, and dynamic light propagation where the time dependence of the nanostructure drastically influences the flow of light.

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**NBR: 279278** **ACRONYM: CARBONNEMS** **EC FUND: 1996788**

**DG:** ERCEA **Call: ERC-2011-StG_20101014** **Thema:** ERC-SG-PE3

**Title:** NanoElectroMechanical Systems based on Carbon Nanotube and Graphene

**Abstract:** Carbon nanotubes and graphene form a class of nanoscale objects with exceptional electrical, mechanical and structural properties. I propose to exploit these unique properties to fabricate and study various nanoelectromechanical systems (NEMS) based on graphene and nanotubes. Specifically, I will address two directions with major scientific interests: 1- I propose to study electromechanical resonators based on an individual nanotube or on a single layer of graphene. My group has a leading position in

this recent research field and the idea is to take advantage of our expertise for two sets of experiments, one on inertial mass sensing and one on the exploration of quantum motion. These two topics are generating at present an intense activity in the NEMS community. Experiments are usually carried out using microfabricated silicon resonators but the ultra low mass of nanotubes and graphene has here an enormous asset. It drastically improves the sensitivity of mass sensing and it dramatically enhances the amplitude of the motion in the quantum regime. 2- My team will fabricate and exploit nanomotors based on nanotube and graphene. Only few man-made nanomotors have been demonstrated so far. Reasons are multiple. For instance, the fabrication of nanomotors is technically challenging. In addition, friction forces are often so strong that they hinder motion. Because of their unique properties, nanotubes and graphene represent a material of choice for the development of new nanomotors. We will construct nanomotors with different layouts and address how electrical, thermal or chemical energy can be transformed into mechanical energy in order to drive motion at the nanoscale.

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**NBR: 279288** **ACRONYM: IDEA** **EC FUND: 5897395**

**DG:** RTD **Call: FP7-HEALTH-2011-two-stage** **Thema:** HEALTH.2011.1.4-2

**Title:** Identification, homing and monitoring of therapeutic cells for regenerative medicine â€“ Identify, Enrich, Accelerate

**Abstract:** Regenerative medicine focuses on repairing or replacing tissue or organ function lost due to damage or congenital defects using appropriate cells for therapy that have healing capacities like stem cells or progenitor cells. Although regenerative medicine has the potential for more effective therapeutic interventions major improvement in three areas are still needed for a wider establishment of such new concepts in clinical practise: identification of the appropriate cells with healing capacity for the use in therapy, homing of these cells to the damaged tissue, and monitoring of the therapeutic intervention and effect. Thus, a multidisciplinary consortium has set up IDEA, a 60 month collaborative project to develop and establish: • Photonic methods that allow a contact and marker-free identification and selection of cells with healing capacity for vascular, musculoskeletal and neuronal tissue defects; • Magnetic cell select devices that capture and transport cells with healing potential through the circulatory system to damaged tissue and organs improving homing; • Tracer and imaging technologies to monitor the therapeutic effects of interventional regenerative medicine by showing anatomic structure AND demonstrating cellular function using magnetic resonance imaging (MRI) and a new imaging technology known as magnetic particle imaging (MPI). The IDEA project is intended to provide collaboration between scientists and clinicians from Karolinska Institute (Stockholm, Sweden), Kings College (London, UK), Paracelsus Medical University (Salzburg, Austria) and Julius-Maximilians-University (Würzburg, Germany) together with experts from SMEs specialized in photonic technologies for

tissue engineering, medical device manufacturing with extensive experience in regulatory approval, the design, synthesis and up-scaling of nanoparticles for molecular imaging, and regulatory affairs. This multidisciplinary consortium will address scale-up, regulatory work and exploratory clinical investigations using the developed tools, technologies and devices in the time frame of the project.

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**NBR: 279342** **ACRONYM: INSITUNANO** **EC FUND: 1367834**

**DG:** ERCEA **Call: ERC-2011-StG_20101014** **Thema:** ERC-SG-PE4

**Title:** In-situ metrology for the controlled growth and interfacing of nanomaterials

**Abstract:** This proposal will use novel in-situ metrology to probe the atomic level mechanisms that govern the growth and device behaviour of nanomaterials in realistic process environments. We focus on the catalytic chemical vapour deposition of carbon nanotubes, graphene, Si/Ge nanowires and related heterostructures. The application potential for these nanostructures is large, but currently limited by insufficient control of growth. We propose to use a range of complementary in-situ probes, including environmental transmission electron microscopy, high-pressure X-ray photoelectron spectroscopy (XPS), in-situ X-ray diffraction (XRD) and in-situ Raman spectroscopy, to significantly advance the understanding of their growth mechanisms. We see these nanomaterials as model systems to advance the fundamental understanding of phase behaviour, nucleation and interface dynamics in nanoscale systems, which is the key to future materials design. Deeper insights into these phenomena are also crucial to understand the behaviour of nanomaterials under device operation conditions. We propose to address critical performance parameters of nano-structured Si-based anodes for Li ion batteries by in-situ nuclear magnetic resonance (NMR) spectroscopy and in-situ XRD methods under repeated Li cycling in an operational battery. We further propose to study the morphological origins of the collective adhesive and mechanical properties of carbon nanotube forests by in-situ scanning electron microscopy as basis for the design of biomimetic, functional dry adhesives and compliant interconnect structures.

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**NBR: 279361** **ACRONYM: MACONS** **EC FUND: 1371893**

**DG:** ERCEA **Call: ERC-2011-StG_20101014** **Thema:** ERC-SG-PE5

**Title:** A multi-microscopy approach to the characterisation of Nitride semiconductors (MACONS)

**Abstract:** The commercial market for electronic and optoelectronic devices based on nitride semiconductors is growing extremely fast, but the fundamental science underlying these

devices is lagging behind. This proposal aims to explore the vital link between structure and properties in nitride materials, in order to reveal the limitations of current devices and to pave the way for new, improved technology. The key strategy of the proposal is to combine multiple microscopy techniques to develop a comprehensive understanding of nanostructures and defects in the nitrides, and to link these discoveries to nanoscale measurements of the optical and electrical properties. This will require a synergy of different techniques, from techniques commonly used on metals (such as atom-probe tomography) to techniques which focus exclusively on semiconductors (such as scanning capacitance microscopy). It will also require the development of new approaches to the application of these techniques, to allow the same nanoscale regions of material to be assessed in multiple microscopes, so that the structure and composition of a specific nanostructure may be linked directly and unambiguously to its electrical and optical properties. Overall, the aim is to provide a much more complete picture of nitride materials science than has ever previously been achieved, and to apply this new understanding to engineering improved materials for nitride optoelectronic devices.

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**NBR: 279494** **ACRONYM: NEWNANOSPEC** **EC FUND: 1488077**

**DG:** ERCEA **Call: ERC-2011-StG_20101014** **Thema:** ERC-SG-PE4

**Title:** New tools for nanoscale optical spectroscopy -Functional imaging of single nanostructures using antennas"

**Abstract:** Optical microscopy forms the basis of most of the natural sciences. Besides the direct visualization of objects hidden to the unaided human eye, optical spectroscopy – or in other words “colour vision”- is of prime importance providing information on electronic and vibronic properties. In addition, experiments using ultrafast laser pulses provide the highest possible temporal resolution enabling real-time observations of photo-induced processes. Conventional microscopy, however, suffers from diffraction resulting in limited spatial resolution of about 300 nm and low signal levels. The aim of this proposal is to develop novel spectroscopic tools with sub-diffraction resolution. Our approach is based on the localization and enhancement of light-matter interactions using optical antennas. We have shown that antenna-enhanced microscopy provides 10 nm resolution combined with enormous signal amplification and now envision new techniques that extend existing schemes into the femtosecond time-domain with further improved image contrast. Semiconductor nanowires and carbon nanotubes possess unique properties crucial to many areas of technology including communications, alternative energy and the biological sciences. At present, there is a significant lack of understanding regarding the physics of these materials. For example, the correlation between local atomic structure and the resulting optical and functional properties. We will first address fundamental scientific questions arising from highly localized optical probing and explore new phenomena including antenna-enhanced single photon emission and energy transfer. Using our newly developed tools, we will

study functional properties of single nanostructures and demonstrate antenna-enhanced light-detection and generation. In summary, our work will lead to fundamentally new optical tools providing unprecedented insights into nanostructures and will substantially advance our understanding of light-matter interactions.

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**NBR: 279505** **ACRONYM: MEGA-XUV** **EC FUND: 1500000**

**DG:** ERCEA **Call: ERC-2011-StG_20101014** **Thema:** ERC-SG-PE3

**Title:** Efficient megahertz coherent XUV light source

**Abstract:** Coherent extreme ultraviolet (XUV) light sources open up new opportunities for science and technology. Promising examples are attosecond metrology, spectroscopic and structural analysis of matter on a nanometer scale, high resolution XUV-microscopy and lithography. The most promising technique for table-top sources is femtosecond laser-driven high-harmonic generation (HHG) in gases. Unfortunately, their XUV photon flux is not sufficient for most applications. This is caused by the low average power of the kHz repetition rate driving lasers (

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**NBR: 279548** **ACRONYM: PROGRAM-NANO** **EC FUND: 1300932**

**DG:** ERCEA **Call: ERC-2011-StG_20101014** **Thema:** ERC-SG-PE5

**Title:** Programmed Nanostructuration of Organic Materials

**Abstract:** “Program-Nano” aims at establishing unconventional and versatile strategies towards organic architectures whose size, composition, internal structure, and function can be rationally predesigned and controlled. In a bio-inspired manner, we will “program” functional molecules with the required information to self-assemble into unique, well-defined nanofibers or nanotubes. We want to focus on two main ambitious objectives for the application of such organic nanostructured materials. 1) The design and preparation of optoelectronic devices, such as plastic solar cells, where nanostructured fibers are integrated within the active layers. The major goal is to determine the influence of the molecular organization and the morphology at the nanoscale on the performance of the device, and to try in this way to set new records in device efficiency. 2) The fabrication of plastic nanoporous materials for the separation, storage or catalytic transformation of (bio)molecules in which the size, the shape ratio, and the internal functionalization of the nanopores can be custom-tailored.

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**NBR: 279587** **ACRONYM: OASIS** **EC FUND: 1242478**

**DG:** ERCEA **Call: ERC-2011-StG_20101014** **Thema:** ERC-SG-PE5

**Title:** Organic/inorganic hybrids for solution-processable photonic structures

**Abstract:** The realisation that modulated light pulses can be confined over long distances with minimum losses within a structure that comprises a controlled spatial distribution of the refractive index n – as, e.g. in optical fibres – has, without doubt, underpinned the telecommunications revolution witnessed during the 20th century. The refractive index n, quantifying how light propagates in a given medium, has as a consequence become one of the most important materials properties in designing photonics products. The other key information for most optical and photonic applications is to know how much light is absorbed by a material. This is described by the extinction coefficient κ. There is, though, an apparent lack of solution-processable systems of κ close to 0 (i.e. are transparent) whilst n can be manipulated over a broad window – a bottleneck that has rendered fabrication of a range of optical structures impracticable, if not impossible. Here we address this issue and advance versatile, solution-processable polymer/inorganic hybrids whose refractive index n can be tuned over a wide range without compromising their transparency nor processability. The programme will develop in three directions: i) the design of novel, solution-processable molecular hybrids; ii) the development of (nano-)fabrication technologies for the deposition and/or patterning of such hybrids; and iii) extension of the range of currently explored photonic crystals to entirely new optical devices. Hence, we have identified a clear need for new materials with increased optical functionalities, and novel concepts and approaches that will allow simple fabrication of structures to light. Key objective for the proposed programme thus is to advance new hybrids, develop a deeper understanding of key structure-property interrelationships of inorganic/organic hybrids and develop novel photonic architectures.

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**NBR: 279632** **ACRONYM: AGGLONANOCOAT** **EC FUND: 1409952**

**DG:** ERCEA **Call: ERC-2011-StG_20101014** **Thema:** ERC-SG-PE8

**Title:** The interplay between agglomeration and coating of nanoparticles in the gas phase

**Abstract:** This proposal aims to develop a generic synthesis approach for core-shell nanoparticles by unravelling the relevant mechanisms. Core-shell nanoparticles have high potential in heterogeneous catalysis, energy storage, and medical applications. However, on a fundamental level there is currently a poor understanding of how to produce such nanostructured particles in a controllable and scalable manner. The main barriers to achieving this goal are understanding how nanoparticles agglomerate to loose dynamic

clusters and controlling the agglomeration process in gas flows during coating, such that uniform coatings can be made. This is very challenging because of the two-way coupling between agglomeration and coating. During the coating we change the particle surfaces and thus the way the particles stick together. Correspondingly, the stickiness of particles determines how easy reactants can reach the surface. Innovatively the project will be the first systematic study into this multi-scale phenomenon with investigations at all relevant length scales. Current synthesis approaches – mostly carried out in the liquid phase – are typically developed case by case. I will coat nanoparticles in the gas phase with atomic layer deposition (ALD): a technique from the semi-conductor industry that can deposit a wide range of materials. ALD applied to flat substrates offers excellent control over layer thickness. I will investigate the modification of single particle surfaces, particle-particle interaction, the structure of agglomerates, and the flow behaviour of large number of agglomerates. To this end, I will apply a multidisciplinary approach, combining disciplines as physical chemistry, fluid dynamics, and reaction engineering.

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**NBR: 279705** **ACRONYM: NANOSTRUCTURE** **EC FUND: 1694608**

**DG:** ERCEA **Call: ERC-2011-StG_20101014** **Thema:** ERC-SG-PE5

**Title:** Solving the nanostructure problem: Understanding, exploiting and designing functional disordered materials

**Abstract:** Many materials of fundamental importance possess structures that do not exhibit long-range periodicity. The absence of Bragg reflections in the diffraction patterns of these materials precludes the use of traditional crystallographic techniques as a means of determining their atomic-scale structures. Yet it is clear that these materials do possess well-defined local structure on the nanometre scale; moreover it is often this local structure that is implicated in the particular physical properties of interest. For this reason, the development of systematic information-based methodologies for the determination of local structure in disordered materials remains one of the key challenges in modern structural science; this is sometimes referred to as the "nanostructure problem". This proposal addresses this issue by aiming (i) to develop robust methodologies for determining nano-scale structure in amorphous and highly-disordered systems, with an emphasis on laboratory-based techniques, (ii) then to use these techniques to develop structural models that will help address key scientific questions in a broad range of fields, and (iii) to apply the intuition gained to design new materials that exploit disorder to yield next-generation materials with desirable functionalities.

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**NBR: 279738** **ACRONYM: NEDFOQ** **EC FUND: 679639**

**DG:** ERCEA **Call: ERC-2011-StG_20101014** **Thema:** ERC-SG-PE3

**Title:** Non-equilibrium dynamics of quantum fluids in one dimension

**Abstract:** This research proposal addresses non-equilibrium processes occurring in one-dimensional quantum fluids. The interest to this area has surged in recent years due to the rapid development of fabrication and measurement techniques in nanophysics and physics of ultra-cold atomic gases. Nanoelectronics devices (such as quantum point contacts, nanotubes and organic nanowires) and ultracold gases in elongated optical traps are the experimental systems where one-dimensional quantum fluids are encountered. While the main focus of nanoelectronics has always been on the electrical and spin transport, with only limited access to other aspects of non-equilibrium dynamics, the amazing degree of control over atomic systems has transformed the physics of one-dimensional fluids into a rapidly expanding universe of non-equilibrium phenomena. Quantum quenches, explosions and collisions of atomic clouds, diffusion and drift of quantum impurities, motion and decay of solitary waves have been observed and mapped in real time measurements. The fundamental value of the research in this direction lies in the strongly correlated nature of one-dimensional quantum systems, which makes their kinetic theory a largely unexplored territory. For these systems, the application of traditional tools of the kinetic theory, such as the Boltzmann collision integral and non-linear equations of hydrodinamics meets with serious conceptual difficulties. Indeed, it is usually impossible to represent the low-energy excitations of a one-dimensional system as a collection of weakly interacting quasiparticles. It is also impossible to consistently quantize non-linear hydrodynamcis within the standard framework of perturbative quantum field theory. The main goal of this project is to develop methods bypassing these difficulties and to formulate a theoretical framework suitable for the description of non-equilibrium phenomena in one dimension.

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**NBR: 279818** **ACRONYM: NANOP** **EC FUND: 1497620**

**DG:** ERCEA **Call: ERC-2011-StG_20101014** **Thema:** ERC-SG-PE4

**Title:** Nanoporous Membranes for High Throughput Rare Event Bio-analysis

**Abstract:** A novel analytical platform is proposed to detect and identify DNA at low concentration in a high throughput manner at the single molecule level. The potential impact of this research is significant and will result in single molecule detection becoming a mainstream tool within the medical diagnostics and analytical communities. 'Rare event' detection plays an important role in the early detection of illnesses and disease (e.g. cancers and bacterial infections). Using analytical technologies that exist today it is almost impossible to detect a single DNA strand within a standard blood sample (of a few mLs) within a reasonable time frame. The technology that will be developed within

the current project will allow for such detection to be performed both rapidly and efficiently. If successful, the core technology described will become a mainstream analytical tool that will be of significant benefit within biomedical laboratories, hospitals, and clinics around the world. Specifically, chemical and semiconductor processing methods will be developed to define a novel approach to high throughput DNA quantification at the single molecule level. This innovative technology will function by introducing biological samples in micro- and nanofluidic chips and using electric fields to direct DNA strands through nanometre-sized pores on a membrane. Detection and sizing of the individual DNA strands (labelled with fluorophores) is then accomplished using confocal fluorescence spectroscopy. This new approach to high-throughput, single molecule DNA analysis harnesses the strengths of both analytical spectroscopy and silicon fabrication technology to allow the creation of hybrid devices in which molecular quantification can be realized. I expect this work to have major impact and open up new possibilities for nano-analytical tools in the chemical and biological sciences.

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**NBR: 279867** **ACRONYM: RFMIFICS** **EC FUND: 1242000**

**DG:** ERCEA **Call: ERC-2011-StG_20101014** **Thema:** ERC-SG-PE8

**Title:** RF-enhanced Microprocessing for Fine Chemicals Synthesis using Catalysts Supported on Magnetic Nanoparticles

**Abstract:** This proposal aims at further strengthening the current line of the applicant's research in the area of nontraditional energy sources and structured reactors. Novel and challenging reactor concepts and technologies are proposed for newly emerging liquid phase catalytic processes for, amongst others, fine chemicals and pharmaceuticals synthesis. Catalytic processes in the liquid phase are crucial in the manufacturing of fine and specialty chemicals. It is widely accepted that the activity of a solid catalyst suspended in a liquid phase can benefit greatly from the use of smaller catalyst particles to avoid mass-transfer limitations. However, the difficulties in recovering small particles from the reaction mixture severely circumvent their industrial applications. To overcome the above drawbacks, the separation of suspended magnetic catalyst bodies from the liquid system using an external magnetic field is proposed. Functionalized magnetic bimetallic nanoparticles are leading candidates for catalytic applications as a vector for magnetic guidance. Their appclication will provide reactors and processes for synthetic routes and high-value added products with optimal space-time yields, minimum waste production, minimum energy consumption, and minimum operating costs. Two novel reactor concepts are proposed in this ERC starting grant program with the aim to develop and demonstrate continuous flow reactors, viz. (1) the RF-heated reactor where catalytically active magnetic nanoparticles are hold in the reactor by an external magnetic field while being heated, and (2) the micro-flow through reactor for magnetic NP manipulation, where mixing in laminar flow is improved by quadrupolar actuation created by a quadrupolar micro magnet arrangement along the channel.

**NBR: 279881** **ACRONYM: HYPER** **EC FUND: 1870337**

**DG:** ERCEA **Call: ERC-2011-StG_20101014** **Thema:** ERC-SG-PE3

**Title:** Hybrid Photovoltaic Energy Relays

**Abstract:** Photovoltaic (PV) solar cells promise to be a major contributor to our future energy supply, and the current silicon and thin film photovoltaic industry is growing at a fast rate (25 to 80% pa). Despite this however, only 10 to 20 GW of the total 15TW global energy demand is met by PV generated power. The ramping up in production and affordable global uptake of solar energy requires a significant reduction in materials and manufacture costs and furthermore, a solar industry on the TW scale must be based on abundant and preferably non-toxic materials. The challenge facing the photovoltaic industry is cost effectiveness through much lower embodied energy. Plastic electronics and solution-processable inorganic semiconductors can revolutionise this industry due to their ease of processing (low embodied energy), but a significant increase in performance is required. To enable this jump in performance in a timely manner, incremental improvements and optimisations (evolutionary approaches) are unlikely to provide sufficiently rapid advances and a paradigm shift, such as that described in this project, is thus required. HYPER is lead by Henry Snaith, a prominent young scientist developing hybrid and organic based solar cells. The project will create a new series of hybrid solar cells, based on photoactive semiconductor nanocrystals and light absorbing polymer semiconductors. At the core of the research is the synthesis of new semiconductor and metallic nanostructures, combined with device development and advanced spectroscopic characterisation. The central operational principle to be developed is long range energy transfer of photoexcitons from the bulk of the semiconductors to the charge generating material interfaces, maximising charge generation in these thin film composites Combined with this, advanced photonic structuring of the photoactive layers, and the introduction of nano-plasmonic light harvesting components will represent a new paradigm for hybrid solar cells.

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**NBR: 279898** **ACRONYM: MONTES** **EC FUND: 1471200**

**DG:** ERCEA **Call: ERC-2011-StG_20101014** **Thema:** ERC-SG-PE2

**Title:** Molecular Networks with precision Terahertz Spectroscopy

**Abstract:** Terahertz frequencies match the vibrations between large functional groups in molecular networks from macromolecules, nano-droplets to proteins. If we are able to measure these oscillations we can decipher the structure and the long-range

interactions in large molecular systems. This yields a precise fingerprint of the molecule that is highly useful for sensitive trace analysis. However, despite of a lot of research in the field, high precision spectroscopy in the former terahertz gap for isolated large molecular networks has not been developed yet. In this project I will develop the necessary tools to measure terahertz transition frequencies in large, mass-selected molecular systems with high resolution. For this purpose a cryogenic radiofrequency ion trap will be coupled to a terahertz resonator cavity. This will allow excitation of a dilute sample of molecular ions in well-defined internal quantum states with single-frequency terahertz radiation. My vision is to achieve high spectral resolution and single-ion sensitivity for almost arbitrarily large molecular systems in the terahertz regime which will initiate a new field for molecular spectroscopy. To explore the potential of the newly-developed methods, I propose to study molecular networks of fundamental importance in chemistry, biology and astronomy. Vibration-tunneling dynamics will be studied in water cluster ions. Torsional motion of biological chromophores and its role in the quenching of the fluorescent state will be investigated. And the spectral signatures of molecules that are promising candidates for detection in the interstellar medium will be determined.

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**NBR: 279985** **ACRONYM: BIHSNAM** **EC FUND: 1004400**

**DG:** ERCEA **Call: ERC-2011-StG_20101014** **Thema:** ERC-SG-PE8

**Title:** Bio-inspired Hierarchical Super Nanomaterials

**Abstract:** Nanomaterials such as carbon nanotubes or graphene sheets represent the future of material science, due to their potentially exceptional mechanical properties. One great drawback of all artificial materials, however, is the decrease of strength with increasing toughness, and viceversa. This problem is not encountered in many biological nanomaterials (e.g. spider silk, bone, nacre). Other biological materials display exceptional adhesion or damping properties, and can be self-cleaning or self-healing. The “secret” of biomaterials seems to lie in “hierarchy”: several levels can often be identified (2 in nacre, up to 7 in bone and dentine), from nano- to micro-scale. The idea of this project is to combine Nature and Nanotechnology to design hierarchical composites with tailor made characteristics, optimized with respect to both strength and toughness, as well as materials with strong adhesion/easy detachment, smart damping, self-healing/-cleaning properties or controlled energy dissipation. For example, one possible objective is to design the “world’s toughest composite material”. The potential impact and importance of these goals on materials science, the high-tech industry and ultimately the quality of human life could be considerable. In order to tackle such a challenging design process, the PI proposes to adopt ultimate nanomechanics theoretical tools corroborated by continuum or atomistic simulations, multi-scale numerical parametric simulations and Finite Element optimization procedures, starting from characterization experiments on biological- or nano-materials,

from the macroscale to the nanoscale. Results from theoretical, numerical and experimental work packages will be applied to a specific case study in an engineering field of particular interest to demonstrate importance and feasibility, e.g. an airplane wing with a considerably enhanced fatigue resistance and reduced ice-layer adhesion, leading to a 10 fold reduction in wasted fuel.

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**NBR: 280043** **ACRONYM: HYBRIDNANO** **EC FUND: 1780442**

**DG:** ERCEA **Call: ERC-2011-StG_20101014** **Thema:** ERC-SG-PE3

**Title:** Engineering electronic quantum coherence and correlations in hybrid nanostructures"

**Abstract:** Nanoelectronic devices can provide versatile and relatively simple systems to study complex quantum phenomena under well-controlled, adjustable conditions. Existing technologies enable the fabrication of low-dimensional nanostructures, such as quantum dots (QDs), in which it is possible to add or remove individual electrons, turn on and off interactions, and tune the properties of the confined electronic states, simply by acting on a gate voltage or by applying a magnetic field. The hybrid combination of such nanostructures, having microscopic (atomic-like) quantum properties, with metallic elements, embedding different types of macroscopic electronic properties (due, e.g., to ferromagnetism or superconductivity), can open the door to unprecedented research opportunities. Hybrid nanostructures can serve to explore new device concepts with so far unexploited functionalities and, simultaneously, provide powerful tools to study fundamental aspects of general relevance to condensed-matter physics. Only recently, following progress in nanotechnology, have hybrid nanostructures become accessible to experiments. Here we propose an original approach that takes advantage of recently developed self-assembled QDs grown on Si-based substrates. These QDs have many attractive properties (well-established growth, ease of contacting, etc.). We will integrate single and multiple QDs with normal-metal, superconducting, and ferromagnetic electrodes and explore device concepts such as spin valves, spin pumps, and spin transistors (a long standing challenge). Using these hybrid devices we will study spin-related phenomena such as the dynamics of confined and propagating spin states in different solid-state environments (including superconducting boxes), long-distance spin correlations and entanglement. The new knowledge expected from these experiments is likely to have a broad impact extending from quantum spintronics to other areas of nanoelectronics (e.g. superconducting electronics).

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**NBR: 280048** **ACRONYM: ECOMAGICS** **EC FUND: 1495860**

**DG:** ERCEA **Call: ERC-2011-StG_20101014** **Thema:** ERC-SG-PE3

**Title:** Electric Control of Magnetization Dynamics

**Abstract:** In this proposal a new electric field based approach for the control of magnetization dynamics is discussed. The advantage of using electric fields compared to magnetic fields is twofold: (i) electric fields are easy to confine in nano-structures (screening), and (ii) no current flow is required which may allow for the development of new spintronic devices with ultra low power consumption. Physically the application of an electric field to an ultrathin ferromagnetic material gives rise to modification of the wave-function overlap at the interface between a ferromagnetic metal and a dielectric. This electronic tuning causes a modified occupation of the d-orbitals at the interface and leads to electrically induced anisotropies. Hence external electric fields generate internal magnetic fields. Due to the modified orbital moment also a large voltage induced effect on the Gilbert damping is expected in magnetization dynamic experiments. In principle these fields can be applied even on ultrafast time scales. This will be explored when rf-electric fields are used to drive internal magnetic fields in the GHz frequency range to generate spin-waves. Furthermore this technique will be used to excite monochromatic spin-waves with wave-vectors well in the exchange dominated regime in order to study their propagation properties. I propose to use the spin-wave Doppler effect in order to break the intrinsic mirror symmetry required in for four-magnon scattering processes. In this way the resonance saturation may be tuned electrically to much larger values. Moreover electrically driven surface acoustic waves will be used to generate spin-waves which will be manipulated by an electric current using the spin-wave Doppler effect. The research described in the proposal is likely to have a large impact as a shift to electric field controlled spintronic devices is favorable on small length scales. In addition the power consumption of these devices may be reduced significantly.

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**NBR: 280064** **ACRONYM: PLASMHACAT** **EC FUND: 1499120**

**DG:** ERCEA **Call: ERC-2011-StG_20101014** **Thema:** ERC-SG-PE5

**Title:** Plasmonics-based Energy Harvesting for Catalysis

**Abstract:** Many critical photochemical and photophysical processes, from photosynthesis in plants, to photocatalytic reactions, and to generation of electricity in solar cells, depend on an efficient light-matter interaction. In order to increase, for example, the efficiency of photocatalysis, the interaction of the photocatalyst with light has to be increased. This project will pursue two lines of investigation in order to achieve this. Firstly, the concept of light-harvesting will be exploited. Light energy can be harvested by collecting, directing and concentrating it at a reaction center, in a fashion that mimics that used by plants. Secondly, for specific types of catalysis such as noble metal nano-particle (NP) based catalysis, the plasmon light field at the metal NPs can potentially be used to enable a more efficient light-matter interaction. The applicant proposes to combine both approaches, to create a plasmonic antenna to funnel light to a reaction center,

whilst at the same time using the plasmons generated as an efficient reaction field in catalysis. The outcome will make it possible to drastically increase activities of (photo)catalysts, enabling their efficient operation under sunlight or even in weak room light conditions. For this, the project firstly adevelops novel photo-induced synthesis for metal NPs, both in solution and at surfaces, as well as at arranging the NPs in effective antennae. Secondly, microscopy modes will be developed/implemented that allow monitoring the growth of the NPs in situ, that allow checking the quality of the arrays and that allow in situ monitoring of catalytic test reactions. These knowledge will be applied to 'real world' (photo)catalysts (gold NP catalysis and TiO2, respectively). This project will thus result in new light-induced synthesis and fabrication methods of NPs; in new and/or improved microscopy modes and spectroscopic schemes in order to study the relationship between plasmonic properties and chemical reactions.

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**NBR: 280078** **ACRONYM: EMATTER** **EC FUND: 1963834**

**DG:** ERCEA **Call: ERC-2011-StG_20101014** **Thema:** ERC-SG-PE8

**Title:** New materials for energy production and sustainable energy use

**Abstract:** The proposed research is in the field of nanofiber materials, focusing on the development of functional nanofibers for the complementary purposes of energy production and sustainable energy use. Significant opportunities exist in these areas, stemming from the development of several methods in the last decade for higher capacity nanofiber production, as well as the strategic need to find alternatives to current production of energy and its uses. Nanofibers are expected to bring revolutionary advances to these and many other fields of science and technology, including catalysis, filtration, protein separations, tissue engineering, and flexible electronics. We will work on creating such materials with potential applications in multi-exciton photovoltaics and catalysis for energy production. For sustainable energy use, we will develop bioinspired responsive materials and architectures, which would store energy, release it on demand, and act as life-like, efficient, and autonomous entities. Fundamental questions we will address in the research include: How do we tailor semiconductor band structures, as well as achieve nanoscale morphologies for efficient dissociation of photogenerated excitons? Can we develop general predictive rules for the conditions needed to fabricate nanofibers from any polymer solution by liquid shear processing? Can the molecular crystallinity and porosity be controlled in the fibers? What are the simplest life-like, autonomous devices that could be made with synthetic materials? This work will include extensive solution-based synthesis, processing, structural and chemical characterization (by optical and electron microscopy, small angle X-rays), physical property measurements (mechanical, optical, electronic), device fabrication and assembly, and computer simulations. Most of the facilities needed for the research are available in Cambridge, and some will be arranged for through external collaborations.

**NBR: 280135** **ACRONYM: ANIMETRICS** **EC FUND: 1277969**

**DG:** ERCEA **Call: ERC-2011-StG_20101014** **Thema:** ERC-SG-PE6

**Title:** Measurement-Based Modeling and Animation of Complex Mechanical Phenomena

**Abstract:** Computer animation has traditionally been associated with applications in virtual-reality-based training, video games or feature films. However, interactive animation is gaining relevance in a more general scope, as a tool for early-stage analysis, design and planning in many applications in science and engineering. The user can get quick and visual feedback of the results, and then proceed by refining the experiments or designs. Potential applications include nanodesign, e-commerce or tactile telecommunication, but they also reach as far as, e.g., the analysis of ecological, climate, biological or physiological processes. The application of computer animation is extremely limited in comparison to its potential outreach due to a trade-off between accuracy and computational efficiency. Such trade-off is induced by inherent complexity sources such as nonlinear or anisotropic behaviors, heterogeneous properties, or high dynamic ranges of effects. The Animetrics project proposes a modeling and animation methodology, which consists of a multi-scale decomposition of complex processes, the description of the process at each scale through combination of simple local models, and fitting the parameters of those local models using large amounts of data from example effects. The modeling and animation methodology will be explored on specific problems arising in complex mechanical phenomena, including viscoelasticity of solids and thin shells, multi-body contact, granular and liquid flow, and fracture of solids.

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**NBR: 280140** **ACRONYM: GQEMS** **EC FUND: 1797200**

**DG:** ERCEA **Call: ERC-2011-StG_20101014** **Thema:** ERC-SG-PE3

**Title:** Graphene Quantum Electromechanical Systems

**Abstract:** The aim of this project is to develop a new class of mechanically tunable quantum devices based on graphene. Adopting an innovative and interdisciplinary approach grounded on both engineering-based microsystem technology and low-temperature solid-state physics, we aim at gaining control over the mechanical and electromechanical properties of graphene nano-membranes and suspended graphene nanostructures, in the low and high strain regime. The main motivation for going in this direction is the expectation that being able to access both the electronic and the mechanical degrees of freedom of graphene will allow to explore new regimes of quantum physics, and lead to potentially important technological applications.

Graphene is in fact a unique platform for the development of a new generation of quantum electromechanical systems, not only because of its high carrier mobility, high elasticity and unrivaled material strength, but also because its electronic properties depend sensitively on local strain and mechanical deformations, allowing to envision revolutionary device concepts. This is a timely and highly explorative high-gain/high-risk research project. Its successful accomplishment will set the basis of a novel graphene-based microsystem technology. The project is expected to have an important and far-reaching impact in the fields of nanosystems and graphene physics, not only in terms of potential applications, but also giving an important contribution to the investigation of the fundamental properties of this unique material.

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**NBR: 280221** **ACRONYM: AMPRO** **EC FUND: 1497798**

**DG:** ERCEA **Call: ERC-2011-StG_20101014** **Thema:** ERC-SG-PE5

**Title:** Advanced Electronic Materials and Devices through Novel Processing Paradigms

**Abstract:** I propose a structured multidisciplinary research programme that seeks to combine advanced materials, such as metal oxides and organics, with novel fabrication methods to develop devices for application in: (1) large area electronics, (2) integrated nanoelectronics and (3) sensors. At the heart of this programme lies the development of novel oxide semiconductors. These will be synthesised from solution using precursors. Chemical doping via physical blending will be explored for the tuning of the electronic properties of these compounds. This simple approach will enable the rapid development of a library of materials far beyond those accessible by traditional methods. Oxides will then be combined with inorganic/organic dielectrics to demonstrate low power transistors. Ultimate target for application area (1) is the development of transistors with hole/electron mobilities exceeding 20/200 cm^2/Vs respectively. For application area (2) I will combine the precursor formulations with advanced scanning thermochemical nanolithography. A heated atomic force microscope tip will be used for the local chemical conversion of the precursor to oxide with sub-50 nm resolution. This will enable patterning of nanostructures with desirable shape and size. Sequential patterning of semi/conductive layers combined with SAM dielectrics would enable fabrication of nano-sized devices and circuits. For application area (3), research effort will focus on novel hybrid phototransistors. Use of different light absorbing organic dyes functionalised onto the oxide channel will be explored as a mean for developing high sensitivity phototransistors and full colour sensing arrays. Organic dyes will also be combined with nano-sized transistors to demonstrate integrated nano-scale optoelectronics. The unique combination of bottom-up and top-down strategies adopted in this project will lead to the development of novel high performance devices with a host of existing and new applications.

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**NBR: 280281** **ACRONYM: MESOTAS** **EC FUND: 1260000**

**DG:** ERCEA **Call: ERC-2011-StG_20101014** **Thema:** ERC-SG-PE8

**Title:** Chatting with Neurons: A novel approach to the study of neurophysiologic responses of neuronal tissue in vitro, combining nanotechnology, tissue engineering, microfluidics and neuroelectrophysiology

**Abstract:** Laboratory-on-a-Chip technology was introduced in this field. To avoid the complexity of an animal model and to reduce the number of animals for pre-clinical research cell culture models are important. Here, the combination of microfluidics, tissue engineering and neuroelectrophysiology on MEA-chips is suggested. Because neuronal tissue on chip may act differently from the neurons in their natural environment, the first objective is to follow a systems engineering approach to realize a platform technology, which allows us to reliably co-culture cells in a 3D interconnected configuration, providing an artificially vascularized system on a MEA. For on-line monitoring of the culturing conditions, we will implement micro-total analysis systems (TAS) technology proposing microchip capillary electrophoresis, potentially coupled to mass spectrometry, to correlate electrophysiology with neurochemistry. Previously, it has been demonstrated that physical and chemical micro- and nanostructures influence cell guidance, viability and cell differentiation, so far, unfortunately without a unifying theory to explain the involved mechanisms. Therefore, our second objective is to further our understanding with respect to the influence of nanocues, implementing microfluidic programming to activate porous nanostructures on MEA and investigate cellular signaling and pathway reactions related to the cell's adhesion mechanism. Combining the first and the second objective will allow us to work towards clinical questions of neurodynamic diseases as epilepsy, characterized by intermittent abnormal synchronization of different neuronal populations. We hypothesize that for these disorders, 3D cell co-culture models will resemble the natural neural networks more closely than 2D, which may subsequently serve as a model to study novel therapeutic procedures, for instance selective neurostimulation. Thus, we propose, as our third objective, nanostimulation of neuronal subsystem.

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**NBR: 280393** **ACRONYM: NANOPIGMY** **EC FUND: 3299596**

**DG:** RTD **Call: FP7-NMP-2011-SME-5** **Thema:** NMP.2011.2.1-1

**Title:** More than color: Applying nanotechnologies for the multifunctional ceramic pigments development

**Abstract:** The change in automobile and construction materials requirements has led industries to the modification of bulk materials with nanoparticulate additives or to the application of

later high performance coatings in their materials to obtain better, cleaner, cheaper, faster and smarter products [1]. However, there still exist some barriers to nanotechnology-based products commercialization and use [2]: - Manufacturing processes make the processes more complex - High processing costs for nano-materials - Need of qualified manpower Modification of low-cost pigments could help to introduce nanomaterials (polymers, paints and concrete) in the market as manufacturing processes in automotive and construction sector would not be altered so there would be no need of qualified manpower. The high-performance pigment (HPP) market performed well in 2006 and continued to grow for a number of reasons but many of the raw materials used to manufacture HPPs increased in cost, thereby affecting the selling price of the finished goods to some extent. The price of high-performance pigments is significantly higher than classic pigments, and as a result, there are fewer producers of specialty pigments and higher margins for the products.The use of modified low-cost pigment will help to reduce the price of HPPs and consequently the price of nano-materials. NANOPIGMY project seeks to produce cost-efficient multi-functional ceramic pigments with more functionalities than color to give to the automobile and construction materials (plastic, paint and concrete) the required functionalities through the use of these nanotechnology-based pigments, avoiding thus changes in manufacturing processes.

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**NBR: 280421** **ACRONYM: EXOMET** **EC FUND: 9476000**

**DG:** RTD **Call: FP7-NMP-2011-LARGE-5** **Thema:** NMP.2011.4.0-1

**Title:** Physical processing of molten light alloys under the influence of external fields

**Abstract:** The ExoMet proposal revolves around innovative liquid metal engineering and the application of external physical fields, in order to significantly influence the microstructures and properties of light alloys, such as aluminium and magnesium. Three types of external fields will be explored, namely: electromagnetic, ultrasonic and intensive mechanical shearing. To meet the future EU challenges of lightweighting and pollution reduction, especially relevant in transportation, it is necessary to improve the castability of light alloys, to enhance grain and eutectic refinement in monolithic alloys, and to develop new high-strength nanocomposites using nano-reinforcers which have only recently become available. Significant mechanical property improvements are foreseen in ExoMet - including 50% increases in tensile strength and ductility, as well as creep resistance up to 300-350 degC (currently limited to about 200 degC in Al and Mg alloys). This applies to both shape castings and wrought products like extruded profiles, bar, cable, sheet and plate. Manufacturing scale-up will be tackled in ExoMet, using a variety of techniques such as low and high-pressure die casting, sand casting, investment casting, differential-presssure casting, twin-roll casting, ultrasound-assisted casting and twin-shear casting. The application of external fields to these industrial techniques is novel and would bring about major savings in energy, scrap and processing

cost. Having developed the field-enabled processes and produced high-quality light alloys and nanocomposites, the next stage of ExoMet will be prototypying and the assessment of industrial applications in four selected commercial sectors: (i) automotive powertrain and chassis, (ii) aircraft and aero-engine structures, (iii) space satellite and rockets, and (iv) high-strength high-conductivity Al electrical cabling. Computer modelling, rig-testing, standardisation, life-cycle analysis and patenting will also be undertaken.

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**NBR: 280432** **ACRONYM: EUROTAPES** **EC FUND: 13499939**

**DG:** RTD **Call: FP7-NMP-2011-LARGE-5** **Thema:** NMP.2011.2.2-1

**Title:** European development of Superconducting Tapes: integrating novel materials and architectures into cost effective processes for power applications and magnets.

**Abstract:** High current coated conductors (CC´s) have high potential for developing electrical power applications and very high field magnets. The key issues for market success are low cost robust processes, high performance and a reliable manufacturing methodology of long length conductors. In recent years EU researchers and companies have made substantial progress towards these goals, based on vacuum (PLD) and chemical deposition (CSD) methods, towards nanostructuring of films. This provides a unique opportunity for Europe to integrate these advances in high performance conductors. The EUROTAPES project will address two broad objectives: 1/ the integration of the latest developments into simple conductor architectures for low and medium cost applications and to deliver +500m tapes. Defining of quality control tools and protocols to enhance the processing throughput and yield to achieve a pre-commercial cost target of 100 €/kAm. 2/ Use of advanced methodologies to enhance performance (larger thickness and Ic, enhanced pinning for high fields, reduction of ac losses, increased mechanical strength). Demonstration of high critical currents (Ic>400A/cm-w, at 77K and self-field and Ic>1000A/cm-w at 5K and 15T) and pinning forces (Fp>100GN/m3 at 60 K). The CSD and PLD technologies will be combined to achieve optimized tape architectures, nanostructures and processes to address a variety of HTS applications at self-field, high and ultrahigh magnetic fields. Up to month 36, 3 types of conductors will be developed (RABiT, ABAD and round wire); at Mid Term 2 will be chosen for demonstration during the final 18 months. The consortium consists of 20 partners from 8 member states – 6 universities (Cambridge, UK; Antwerp, B, U.A. Barcelona, ES, TU Cluj, RO, U. Ghent, BE and TU Wien, A), 5 institutes (CSIC-ICMAB, E, ENEA, I, IEE, SK, Inst. Neel-CNRS, F, and IFW, D), 1 technological center (LEITAT, ES) and 8 industrial companies (Bruker, D, Evico, D, Theva, D, Nexans GmbH, D, Percotech, D, Nexans SA, F, Lafarga Lacambra, ES and Oxolutia, ES).

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**NBR: 280433** **ACRONYM: NEUROCARE** **EC FUND: 3619985**

**DG:** RTD **Call: FP7-NMP-2011-SMALL-5** **Thema:** NMP.2011.1.4-4

**Title:** Neuronal NanoCarbon Interfacing Structures

**Abstract:** NeuroCare aims to create better retinal, cortical and cochlear implantable devices through the use of improved interfacing between the electronic implants and living cells. The NeuroCare concept involves low-cost, carbon-based materials, well-adapted for medical implants, because they (i) offer wide range of electronic properties (metal, semiconductor and insulator), (ii) are bio-inert and (iii) are physically robust. Coupling between electronic devices and neurons was recently studied using “soft”, nanocrystalline diamond-based micro-electrode arrays, evaluated in laboratory animals for retinal stimulation. These diamond implants considerably reduced gliosis, enabled stimulation currents to be raised by more than one order of magnitude before causing visible chemical alteration, and enabled long lasting operation with reduced biofouling. Our previous experience with nanocrystalline diamond will be directly built upon through the introduction of atomic layers of graphene to diamond surfaces. NeuroCare will specifically focus on: • Carbon-biointerface development offering reduced biofouling over the state-of-the-art, as set by the DREAMS project and improved biocompatibility • Interfacing of rigid MEAs and FETs with cells and organs to improve bidirectional communication with neurons for in vitro research and pharmacological applications • Nanoscale surface engineering and flexible macroscale implant materials for optimal contact to biological tissue • Making and testing implantable MEAs and FETs for complex multichannel neuronal communication - targeting the specificity in vivo of the implantable devices for 3 high-impact clinical applications Neurocare partners will test interfaceable and implantable devices via in vitro and in vivo testing. NeuroCare federates 12 partners: CEA (LIST and CLINATEC), Ecole Supérieure d'Ingénieurs en Electronique, Forschungszentrum Jülich, Ayanda Biosystems SA, University College London (London Centre for Nanotechnology), Johannes

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**NBR: 280478** **ACRONYM: NANODETECTOR** **EC FUND: 2967949**

**DG:** RTD **Call: FP7-NMP-2011-SME-5** **Thema:** NMP.2011.1.3-1

**Title:** Ultrasensitive plasmonic detection of single nanoparticles

**Abstract:** Controlled or uncontrollabel disposing of nanoparticles in various components of man made or biological matter, may have wanted or undesired consequences. Developing the diagnostic tools to detect and characterize the ’grey goo’ is one of the challeneges of nanotech-era. A development of general technology for detection and analysis of single nanoparticles in complex environment and a development of a laboratory prototype of

the device based on this technology and its application are the goal of this project. The proposal is based on the new experimental phenomenon discovered recently by a project partner: single subwavelength objects give rise to giant optical signals in surface plasmon resonance microscopy. This provides a unique possibility for ultrasensitive on-line detection of engineered nanoparticles. Within the project a development of the device for detection of nanoparticles and its application for a number of practically important tasks will be performed. The work includes a development of theoretical description of the new effect, optimization of main components of the detection system, development of sophisticated software for effective image analyses and isolation of nanoparticle signals from background optical signals and noise. Preliminary experiments demonstrated a possibility to use surface modification to distinguish different types of nanoparticles. Within the project this approach will be used for identification of nanoparticles. Measurements will be performed in aqueous media as well as in air. Inorganic, plastic and protein nanoparticles will be examined. At the final step of the project monitoring of nanoparticles in simple (drinking water, mineral water, air) and complicated (wine, juice and other transparent non-colloidal drinks) will be performed. The end users will test the developed experimental system for monitoring of workplaces and waste during production of inorganic and protein nanoparticles.

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**NBR: 280516** **ACRONYM: V-SMMART NANO** **EC FUND: 3099933**

**DG:** RTD **Call: FP7-NMP-2011-SME-5** **Thema:** NMP.2011.1.4-3

**Title:** Volumetric Scanning Microwave Microscopy Analytical and Research Tool for Nanotechnology

**Abstract:** This project will produce a new tool, the Volumetric Scanning Microwave Microscope (VSMM), for non-destructive 3D nanoscale structural characterisation. Full development of this new tool will take place ready for commercial exploitation within the project duration. The consortium, comprising three SMEs, a Large Company, an RTD Performer and two Research Institutions, will develop and commercialise the VSMM. The VSMM will probe the local reflection and transmission microwave spectroscopy of key materials properties, measuring complex permittivity, conductivity, resistivity, and magnetic response, and hence structural and chemical material constitution with 3D nanoscale resolution. Workpackages will address the technical development of the tool and demonstrate its ability to characterise the 3D structure in situ at the nanoscale with application to relevant real life systems including nanoparticle drug uptake in biological cells, domain structure in ferroelectric devices and trap mechanisms in solar cells. Integrated into this process is ease of use through dedicated work-flows and intuitive real time visualisation for results optimisation and processing. Methods for calibration and provision of traceability are incorporated into the project from the start: this will ensure that VSMM measurements will be quantitatively meaningful and optimised for accuracy and will ensure the most efficient route to commercialisation and uptake of the

VSMM. The project aims to produce significant impact for European SMEs, they will benefit both from the market for SPM probe tips and ancillary equipment (e.g. calibration kits) for the VSMM and as end-users. Finally, the fact that the VSMM will utilise SPM cantilever-probe technology will ensure that it is readily compatible with a full range of other SPM-based tools – opening up its future role in integrated multi-physical materials characterisation at the nanoscale.

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**NBR: 280519** **ACRONYM: NANOSELECT** **EC FUND: 3820899**

**DG:** RTD **Call: FP7-NMP-2011-SMALL-5** **Thema:** NMP.2011.1.2-3

**Title:** Functional membranes/ filters with anti/low-fouling surfaces for water purification through selective adsorption on biobased nanocrystals and fibrils

**Abstract:** NanoSelect aims to design, develop and optimize novel bio-based foams/filters/membranes/adsorbent materials with high and specific selectivity using nanocellulose/nanochitin and combinations thereof for decentralized industrial and domestic water treatment. NanoSelect proposes a novel water purification approach combining the physical filtration process and the adsorption process exploring the capability of the nanocellulose and/or nanochitin (with or without functionalization) to selectively adsorb, store and desorb contaminants from industrial water and drinking water while passing through a highly porous or permeable membrane. Stable membranes/ filters that withstand the flux, pressure etc during the purification process with out compromising on the perm selectivity will be developed by methodologies including control of pore size, orientation of pores, layered multiple functionality, ALD treatment of the porous surface etc. Functional external stimuli sensitive filter surfaces for reduced bio fouling and enhanced filter cleaning or intelligent design of membrane modules allowing self cleaning will be attempted for antifouling and to increase the service-life of the membranes.NanoSelect focuses on the design, development and testing of membrane based prototypes in collaboration with industry with specific focus on the removal of toxic chemicals, heavy metal ions, pesticides, fertilizers etc from contaminated industrial water and portable modules with high selectivity towards bacteria for drinking water. In addition, the membranes will be evaluated for disposal by composting and its impact on environment, at the end-of-life.These biobased functional membranes provides a highly energy efficient but cheaper, biodegradable, non-toxic and green substrate for water treatment. The successful completion of NanoSelect will have far-reaching impact in decentralised water treatment technolog in developing, transitional as well as the industralised countries

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**NBR: 280535** **ACRONYM: SCAFFOLD** **EC FUND: 2537000**

**DG:** RTD **Call: FP7-NMP-2011-SMALL-5** **Thema:** NMP.2011.1.3-2

**Title:** Innovative strategies, methods and tools for occupational risks management of manufactured nanomaterials (MNMs) in the construction industry

**Abstract:** Manufacturated nanomaterials and nanocomposites are being considered for various uses in the construction industry and related infrastructure industries, not only for enhancing material properties and functions but also in the context of energy conservation. Despite the current relatively high cost of nano-enabled products, their use in construction materials is likely to increase because of highly valuable properties imparted at relatively low additive ratios, rapid development of new applications and decreasing cost of base MNMs as they are produced in larger quantities. Thus the use of nano-products in the construction industry is a reality and can be expected to grow in the near future. Consequently, there is a general uncertainty with respect to health and safety risks and how to properly manage them to protect workers and be in compliance with OHS legislation. SCAFFOLD is an industrial oriented idea specifically addressed to provide practical, robust, easy-to-use and cost effective solutions for the European construction industry, regarding current uncertainties about occupational exposure to MNMs. This will be achieved by introducing a new paradigm to improve workers protection against NMs in construction, based on a novel holistic Risk Management approach (RMM). The aim of the SCAFFOLD project is to develop, test, validate and disseminate a new holistic, consistent and cost effective Risk Management Model (RMM) to manage occupational exposure to MNMs in the construction sector. This will be done by integration of a set of innovative strategies, methods and tools developed by the project into consistent state-of-the-art safety management systems (OHSAS 18001 + ISO31000).

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**NBR: 280550** **ACRONYM: INSTANT** **EC FUND: 3771946**

**DG:** RTD **Call: FP7-NMP-2011-SME-5** **Thema:** NMP.2011.1.3-1

**Title:** Innovative Sensor for the fast Analysis of Nanoparticles in Selected Target Products

**Abstract:** INSTANT will face the challenge of the detection, identification and quantification of engineered nanoparticles (ENPs) in complex matrices such as cosmetic products and engineered food and drinks. Therefore, new detection methods and technologies are mandatory. This is completely in line with the Call FP7-NMP.2011.1.3-1 which deals especially with innovative, practically implementable and cost effective measurement approaches for ENPs in complex matrices. Recently emerging ENPs include Ag, SiO2, TiO2, ZnO, and organic NPs. The “Opinion of the Scientific Committee on the Potential Risks Arising from Nanoscience and Nanotechnologies on Food and Feed Safety” released by the European Food Safety Authority (EFSA) (2009) also highlights the urgent need for such a tool. Accordingly, the interdisciplinary project INSTANT will develop an

innovative and integrated technology for monitoring the exposure of consumers to ENPs using a label free opto-electrochemical sensor array in combination with novel recognition elements. The SME driven INSTANT will develop an innovative, cost effective, and easy to use analytical tool to extract, detect and identify ENPs typically used in cosmetic products (e.g. sunscreen, toothpaste, deodorant, ...) and engineered food (e.g. instant soups, ketchup, ice cream, ...) and drinks (e.g. fruit juice, energy drinks, bottled water, ...). A crucial point of measuring in these complex matrices is the sample preparation and extraction. Therefore INSTANT will develop and integrate tailored extraction methods. Especially the size distribution of ENPs in the sample and the influence of the matrix on chemical and physical properties of the ENPs have to be taken into account. The INSTANT device will be designed to be used as a cost effective monitoring tool which is suitable for characterisation and classification of ENPs for the future implementation of quantitative structure-activity relationship studies.

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**NBR: 280566** **ACRONYM: UNIVSEM** **EC FUND: 3596653**

**DG:** RTD **Call: FP7-NMP-2011-SME-5** **Thema:** NMP.2011.1.4-3

**Title:** Universal SEM as a multi-nano-analytical tool

**Abstract:** The current scientific interest and next generation of nanotechnology-based products is combining converging fields and dealing with a large complexity (e.g. organic electronics, nanomedicine). We can see growing needs to visualize, manipulate, modify and characterize nano-objects in a single tool. The aim of the UnivSEM project is to develop a novel multimodal tool combining - a vision capability by integrating scanning electron (SEM), scanning probe (SPM) and optical microscopy (OM) thus enabling multimodal microscopy, - a chemical analysis capability by time-of-flight secondary ion mass spectroscopy (TOF-SIMS) and energy dispersive X-ray (EDX), - structural characterization by electron backscattered diffraction (EBSD), - a non-destructive optical analysis capability by confocal Raman spectroscopy and cathodoluminescence (CL), - a tomography capability by complementary use of novel 3D orthogonal TOF-SIMS, 3D EBSD and 3D confocal Raman tomography (the last method being non-destructive) thus enabling correlation between alternative 3D methods. The proper resolution will be ensured by SEM column improvements, a new SPM design and OM type of Raman microscopy in SEM. Implementation of nano-scale 3D imaging, manipulation and non-destructive optical analysis in one universal instrument will represent a real breakthrough allowing simple operations or analyses in nanotechnology that are problematic or impossible nowadays. The fully functional prototype of the new tool will demonstrate its unique modularity, resolution, data acquisition and simplification of working environment. Direct application of this multimodal tool is expected in many industrial quality controls and in R&D sectors (e.g. photovoltaics, plasmonics and cell-nanoparticle interaction).

**NBR: 280581** **ACRONYM: NANOMEND** **EC FUND: 7250000**

**DG:** RTD **Call: FP7-NMP-2011-LARGE-5** **Thema:** NMP.2011.1.4-2

**Title:** Nanoscale Defect Detection, Cleaning and Repair for Large Area Substrates

**Abstract:** NANOCleaR will pioneer efforts to develop better, more integrated process inspection, cleaning, repair and control systems for nano-scale thin films on large area foils, and will do so in two exemplar vertical supply chains for functionalized polymer-coated paper products and for low cost flexible photovoltaics (PV). The aim is to demonstrate beyond state-of-the-art in-line detection, cleaning and repair of micro and nano-scale defects. The NANOCleaR strategy to develop novel optical inspection methods has three strands: 1.Enhance the effective lateral resolution and the vertical resolution of high speed optical inspection systems currently used to scan large area foils. 2. Develop high precision optical interferometric sensors with significantly higher spatial range and scan speed than existing laboratory interferometers. 3.Build and test prototype optical interferometers that can detect defects which have a spatial size below the diffraction limit (down to approximately 10nm) by utilizing a priori knowledge of the geometry of the defects and inverse modeling approaches. The NANOCleaR strategy for cleaning is to decrease defect density and enhance yield by using directional cleaning methods optimized for i) continuous operation to remove sub-micron defects from large area foils prior to barrier deposition and ii) local removal of particles generated during fabrication of PV modules. Local repair techniques will be investigated in particular for interconnection defects detected near the end of PV module manufacture where the value of the work to be recovered is very high. NANOCleaR solutions proposed for inspection, cleaning and repair will be integrated into a) production of large-area photovoltaic panels for use in building-integrated systems with demonstrable long life (15-20 years) and b) production of polymer-coated papers used in fibre-based packaging solutions.

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**NBR: 280584** **ACRONYM: BIOTRACHEA** **EC FUND: 3999300**

**DG:** RTD **Call: FP7-NMP-2011-SMALL-5** **Thema:** NMP.2011.2.2-2

**Title:** Biomaterials for Tracheal Replacement in Age-related Cancer via a Humanly Engineered Airway

**Abstract:** Age-related cancers, especially of the trachea, are neoplastic lesions that significantly impact upon the lives of thousands of European patients each year. Unfortunately, most present with inoperable lesions for which median survival is less than 12 months. Based

on our previous clinically successful experiences with in vivo completely tissue engineered tracheal replacement in benign tracheal diseases, we recently applied this technology in 2 patients with otherwise inoperable primary tracheal cancers. The successful observed outcome confirms the unique opportunity to scale-up an effective therapeutic approach into a widely accessible clinical technology, which could enhance not only the quality of life but even cure otherwise untreatable patients. However, a limitation of our current technology is the time it takes to re-populate the decellularized trachea. This may prove critical in the case of cancer patients. Further, the size of the transplant is currently limited due to the fact that the transplanted tissue needs to be efficiently and rapidly vascularised to prevent necrosis in vivo. To surmount these limitations, we aim to: i) improve our current technique of in vivo tissue engineering human tracheae in a small number of patients and subsequently begin a formal clinical trial, ii) develop pharmacological approaches to activate endogenous stem cells, stimulate tissue regeneration and vascularisation in situ, iii) develop a synthetic tracheal scaffold using a novel nanocomposite polymer as alternatives to natural human scaffolds and iv) develop good medical practice manufacturing process for safe, efficient and cost effective commercial production. This research project is aimed to define a robust airway implantation technique assuring a better outcome for thousands of patients each year. Moreover, we aim to use these results as a starting point to develop clinical approaches that could improve the treatment of age-related cancers of other hollow organs.

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**NBR: 280595** **ACRONYM: NANOPUR** **EC FUND: 3370722**

**DG:** RTD **Call: FP7-NMP-2011-SMALL-5** **Thema:** NMP.2011.1.2-3

**Title:** Development of functionalized nanostructured polymeric membranes and related manufacturing processes for water purification

**Abstract:** The NANOPUR-project aims at leveraging on promising bottom-up technologies to develop intensified water treatment concepts based on nano-structured and nano-functionalized membranes as well as nanofilm deposition for micropollutants and virus removal. Major research needs targeted include the preparation of membranes with selective properties at the nanoscale able to maintain high permeability with relatively low driving force. The ultimate “challenge” exists in the creation of artificial membranes able to perform separations with the selectivity of biological membranes while having mechanical strength and productivity of state-of-the-art artificial membranes. The project will advance the knowledge in this area by developing scalable approaches to prepare nano-structured membranes characterized by a selectivity towards pathogens of up to 99.99999 % and towards micropollutants up to 99 %, while retaining a permeability higher than current ultrafiltration membranes in addition to functional stability equal to existing commercial membranes. The envisaged research activities will involve the preparation of polymeric nano-structured membranes characterized by well-

controlled architectures and functions for supramolecular recognition for removal of viruses, hormone disruptors, endotoxins and antibiotics from water. For the generation of affinity and catalytic sites on membranes, molecular imprinted polymers and atmospheric pressure plasma treatment will be explored. The technological developments will be carried out along two different technology paths each targeting at a different aspect of the water treatment process. A first research path will focus on the reduction of membrane fouling thereby enhancing the flux while the second research path targets the removal of micro-pollutants and detoxification. Both paths will converge in order to combine the two critical aspects of water purification that are investigated in the proposed work in one single membrane process

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**NBR: 280658** **ACRONYM: FREECATS** **EC FUND: 3955619**

**DG:** RTD **Call: FP7-NMP-2011-SMALL-5** **Thema:** NMP.2011.2.2-4

**Title:** Doped carbon nanostructures as metal-free catalysts

**Abstract:** This project is primarily aimed at generating new fundamental knowledge and fostering new prospects and frontiers in the field of catalysis for the sustainable production of chemicals and commodities. Rethinking important metal-based catalytic processes in the light of new tailored metal-free catalytic architectures designed and fabricated starting from appropriate nanoscale building blocks, is the fundamental target of this research project. Major efforts have been made in the last decades aimed at addressing catalytic approaches, as much as possible, denoted by sustainable and environmentally friendly features. A large fraction of products made today are produced with traditional methods developed several decades ago. In order to keep the European process industry competitive worldwide, the development of technologically advanced processes represent a fundamental prerequisite. The FREECATS proposal deals with the development of new metal-free catalysts, either in the form of bulk nanomaterials or in hierarchically organized structures both capable to replace traditional noble metal-based catalysts in catalytic transformations of strategic importance. The new metal-free catalytic materials will be applied to specific processes traditionally carried out by means of precious metal-based materials. The application of the new materials will eliminate the use for platinum group metals and rare earth elements such as ceria used in fuel cell technology (automotive applications and others), production of light olefins, and in wastewater and water purification. Replacing platinum group metal alternatives in these three emerging technologies will lead to a significant reduction in demand of platinum group metals in Europe, at least mounting to the current automotive platinum group metal demand, estimated to be in the order of 50-100 tons per year.

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**NBR: 280670** **ACRONYM: REFREEPERMAG** **EC FUND: 3841400**

**DG:** RTD **Call: FP7-NMP-2011-SMALL-5** **Thema:** NMP.2011.2.2-4

**Title:** RARE EARTH FREE PERMANENT MAGNETS

**Abstract:** This proposal aims at developing a new generation of novel materials for high performance permanent magnets (PM) with energy product 60 kJ/m3<(BH)max< 160 kJ/m3, which do not contain any rare-earths or platinum. To achieve this objective two strategies will be used: a) exploitation of shape anisotropy of high magnetic moment materials produced in the form of high-aspect-ratio (>5) nanostructures by environmentally friendly synthesis methods and b) using high-throughput (HT) thin film synthesis and characterization techniques to identify new PM candidate phases. The first strategy, through the control of the nanostructure will lead to a factor of 4 increase of the coercivity (over conventional Alnico) . The second strategy will use (HT) methods to screen hundreds of possible compositions and synthesis conditions. Investigations will focus on promising candidate materials of the type {Fe-Co}-X-Y (X = other 3d or 4d metals and Y= B,C,P or N) and Heusler alloys of the type X2YZ (where X is usually Fe, Co, Ni, Cu; Y other transition metals, most often Mn; and Z a group-B element (Al, Ga, Ge, Sn...). High Ms materials that can be stabilized in tetragonal or hexagonal structures by epitaxial growth on selected substrates are the goal with magnetic anisotropies in excess of 107 ergs/cm3.This range covers a wide field of applications and represents a sizeable market fraction of over 100 M€. All research will be performed taking into consideration the critical issues of toxicology and sustainability of the full life cycle of the materials from production to recycling. The consortium will generate breakthroughs to re-establish the EU as a leader in the science, technology and commercialization of this very important class of materials with a wide range of applications, helping to decrease our dependence on raw materials from abroad providing a positive socioeconomic impact and increased employability of young European scientists.

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**NBR: 280676** **ACRONYM: DIBBIOPACK** **EC FUND: 5702632**

**DG:** RTD **Call: FP7-NMP-2011-LARGE-5** **Thema:** NMP.2011.1.1-1

**Title:** DEVELOPMENT OF INJECTION AND BLOW EXTRUSION MOLDED BIODEGRADABLE AND MULTIFUNCTIONAL PACKAGES BY NANOTECHNOLOGY: IMPROVEMENT OF STRUCTURAL AND BARRIER PROPERTIES, SMART FEATURES AND SUSTAINABILITY

**Abstract:** The project aims on the one hand the development of new biobased materials specially adapted to the development of a wide range of containers or packages (films made by extrusion laminating, trays or lids developed by injection moulding and bottles performed through extrusion blow moulding technologies) and the improvement of thermal, mechanical and barrier properties of these packages through nanotechnology and innovative coatings. On the other hand, the project aims the operational integration

of different intelligent technologies or smart devices to provide to the packaging value chain more information about the products and the processes, increase safety and quality of products through supply chain and improve the shelf-life of the packaged products. In both cases, the application of more flexible alternative processes and more environmentally sustainable and efficient technologies will be considered. The project includes the design, development, optimization and manufacturing of multifunctional smart packages, assuring compliance of environmental requirements through LCA and LCC analysis, managing nanotechnology risk through the whole packaging value chain, and finally, end user evaluation in different sectors as cosmetic, pharmaceutic and food industry. The project results and the high impact reached through a wide range of technologies utilized will boost the European Packaging Industry to a higher level.

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**NBR: 280713** **ACRONYM: NANOMICEX** **EC FUND: 3535290**

**DG:** RTD **Call: FP7-NMP-2011-SMALL-5** **Thema:** NMP.2011.1.3-2

**Title:** Mitigation of risk and control of exposure in nanotechnology based inks and pigments - NANOMICEX -

**Abstract:** The main aim of NANOMICEX project is to reduce the potential risk upon workers' exposure to the engineered nanoparticles employed in the operative conditions of the inks and pigments industry, by addressing at the health and environmental consequences associated with the inclusion of nanoadditives within all stages of nanotechnology based products (production, use and disposal). To achieve it, new surface modifiers will be designed and developed to obtain less hazardous and more stable nanoparticles. The proposed work will focus on a selected set of nanoparticles relevant to the ink and pigment sector. Full characterisation will be carried out, followed by an exposure measurement in order to characterise and quantify any potential particle release in the production and processing activities. A comprehensive hazard assessment will allow the evaluation of effects on human and environmental models with comparisons between simple and modified nanoparticles carried out. Results from the assessment studies will be used to compile a risk assessment of the use of nanoparticles in the ink and pigment industry, and comparisons will be made with surface-modified nanoparticles. An evaluation of the effectiveness of risk management measures will be undertaken in order to select and design practical and cost effective strategies, which will be easy to implement in the real operative conditions. As part of this assessment, we will conduct a life cycle assessment, by evaluating their impacts during the whole process of manufacture, use and disposal of these products. The project results will involve industrial partners, providing an integrated strategy to mitigate the risk of workers dealing with nanoparticles, considering all relevant worker exposure scenarios. Furthermore, NANOMICEX will provide industrial stakeholders and the general public with appropriate knowledge on the risks of nanoparticles and nanoproducts, establishing synergies with the EU nanosafety infrastructure.

**NBR: 280716** **ACRONYM: SANOWORK** **EC FUND: 3409185**

**DG:** RTD **Call: FP7-NMP-2011-SMALL-5** **Thema:** NMP.2011.1.3-2

**Title:** Safe Nano Worker Exposure Scenarios

**Abstract:** The main goal of Sanowork project is to identify a safe occupational exposure scenario by exposure assessment in real conditions and at all stages of nanomaterials (NM) production, use and disposal. In order to address this and more specifically the issues introduced by NMP.2011.1.3-2 call, we intend to: 1. contain hazard and worker exposure potential by developing exposure mitigation strategy based on ‘‘Prevention through Design’’ approach. 2. implement a rigorous exposure assessment in the workplace in order to evaluate the effectiveness of existing and proposed exposure reduction strategies. 3. perform risk analysis off line and on site in order to identify substance product properties and operational condition that ensure a safer worker exposure scenario. 4. Assess COST/ EFFICIENCY of the proposed strategies on the basis of risk analysis results, materials/properties efficiency, risk transfer to insurance underwriter community. The Sanowork proposed risk remediation strategy will be applied to nanomaterial properties. The following “representative” pool of NM and nanoproducts have been selected: TiO2 and Ag (ceramic or textile photocatalytic/antibacterial surfaces); CNTs (polymeric nanocomposites); organic/inorganic nanofibers (nanostructured membranes for water depuration system). The strategy is addressed to mitigate risk by decreasing adverse health hazard and emission potential of nanomaterials, setting back processes of transport to the point of entry. A sound balance between exposure and health hazards data, before and after the introduction of existing and proposed risk remediation strategies, will allow to evaluate the effectiveness of existing and proposed exposure reduction strategies. The cooperation with industrial key partners such as Plasmachem, Elmarco, GEA Niro, Colorobbia,Bayer will guarantee an accurate exposure assessment in the workplace.

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**NBR: 280759** **ACRONYM: NANOBARRIER** **EC FUND: 7207600**

**DG:** RTD **Call: FP7-NMP-2011-LARGE-5** **Thema:** NMP.2011.1.1-1

**Title:** Extended shelf-life biopolymers for sustainable and multifunctional food packaging solutions

**Abstract:** The overall concept of NanoBarrier is to develop a new nanotechnology platform based on inorganic-organic hybrid polymers, microfibrillated cellulose, nanocapsules with controlled permeability and additive technology and combine this with resource-

efficient processing technologies to realize safe and extended shelf-life and multifunctional biopolymer food packaging solutions. These solutions based on CO2 neutral and renewable resources, should work as an enabling technology for innovative companies to stimulate to further consumption growth of fish and seafood and environmental conscious packaging solutions for meat and dairy products; food sectors of major social, economical and health impact in the European region. The project will also bring forward robust biopolymer formulations, compounding expertise and coating approaches to combine nanoparticle technology with biopolymer formulations. Dedicated demonstrators are planned based on resource-efficient processing technologies, such as blow moulding and film blowing. The demonstrators will be multifunctional barrier films for meat packaging, multifunctional barrier bottles for liquid yoghurt and milk and multifunctional barrier jars for crab packaging. NanoBarrier will include sustainable parameters from the demonstrator design step applying ecodesign methodology to minimize the environmental, social and economic impact from the early development step. An LCA will quantify the impact of the foreseen demonstrators and measures are taken to evaluate safety. The objectives of the project will be achieved by implementing the work organized in four technical work packages (in addition to a coordination work package) where each WP are designed to fulfill one- or several of the specific scientific objectives in the project. The project consortium cover the whole value chain from manufacture and competence of nanoparticle technology to end-use supply and include leading organizations and competences throughout Europ

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**NBR: 280761** **ACRONYM: ALEXANDER** **EC FUND: 8098202**

**DG:** RTD **Call: FP7-NMP-2011-LARGE-5** **Thema:** NMP.2011.1.2-2

**Title:** Mucus Permeating Nanoparticulate Drug Delivery Systems

**Abstract:** The objective of the ALEXANDER project is the identification of novel strategies (e.g., proteolytic enzyme strategy, thiomer strategy, zeta potential changing systems, SNEDDS strategy) and the optimization of existing strategies (e.g., disulfide breaking strategy and slippery surface strategy) for the efficient transport of nanocarriers through the mucus gel layer (e.g., intestinal, nasal, ocular, vaginal, buccal, pulmonary). In particular, R&D activities will be focused on the synthesis of functionalized nanocarriers capable of permeating the mucus gel layer and delivering their therapeutic payload to the epithelium. The nanocarriers will be characterized with respect to their physicochemical properties, ability to cross the mucus gel layer, in vitro and in vivo cytotoxicity. The potential of the developed nanocarriers as delivery systems for mucosal administration of macromolecules will be demonstrated via the oral delivery of peptides, oligosaccharides and oligonucleotides and the nasal delivery of a plasmid encoding for an antigen.

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**NBR: 280765** **ACRONYM: BUONAPART-E** **EC FUND: 7799929**

**DG:** RTD **Call: FP7-NMP-2011-LARGE-5** **Thema:** NMP.2011.1.4-1

**Title:** Better Upscaling and Optimization of Nanoparticle and Nanostructure Production by Means of Electrical Discharges

**Abstract:** The BUONAPART-E project aims to demonstrate that a physical nanoparticle synthesis process can be economically scaled-up to yield 100 kg/day production rate, which is the target rate mentioned in the Call Topic. The process is simple, versatile, and reliable. It avoids chemical precursors and solvents, while fully recycling the necessary inert carrier gas, resulting in a minimal impact on the environment. The process does not necessitate external heating of the inert gas, thereby keeping energy consumption low. The main goal of the BUONAPART-E is to increase the production rate of a single basic unit in which the evaporation of the raw material is done by electric means by a factor of 10 to 100 and to implement necessary monitoring and collecting tools to ensure high quality product delivery. Experimental results as well as literature data indicate that an energy efficiency of 100 kWh/kg has been reached for a single unit. The challenge addressed in BUONAPART-E, which can only be met with new knowledge of the hitherto unknown fundamental mechanisms taking place, is to obtain an increase in the production rate, while retaining energy efficiency. The process allows for the synthesis of different materials using the same production platform. The basic evaporation unit (called hereafter the Optimal Single Unit or 'OSU') is a set of electrodes. A large number of these units can be placed in a single housing, contributing to the cost-effectiveness of the process. The use of many single production units in parallel, which can be thoroughly optimized and tested on a lab scale for a given material, ensures that a highly-effective scale-up of the synthesis process in terms of cost and energy consumption is possible. Further equipment, such as pumps, power supply to the OSUs and the particle collection unit, can be scaled-up as single units leading to additional cost benefits.

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**NBR: 280772** **ACRONYM: I-ONE** **EC FUND: 3834336**

**DG:** RTD **Call: FP7-NMP-2011-SMALL-5** **Thema:** NMP.2011.1.4-4

**Title:** Implantable Organic Nano-Electronics

**Abstract:** The vision of I-ONE is to exploit for the first time flexible organic electronics for the development and testing of Active Multifunctional Implantable Devices (AMIDs) to treat Spinal Cord Injury (SCI). The devices will (a) have long-term stability associated to high biocompatibility and safety, (b) have reduced risk of a host versus graft immune response, (c) mimic the local microenvironment for stem/precursor cell recruitment and

differentiation, (d) monitor locally the functionality of the regenerated nerve cells to intervene with loco-regional therapies (e) perform local stimulation with tunable electric fields, (f) deliver locally growth factors, neurotransmitters, and drugs. The use of flexible organic electronics devices (ultra-thin film organic field effect transistor (FET), organic electro-chemical transistor, nanoparticle organic memory FET) will advance the state-of-the-art of implantable devices for SCI from passive to active layouts that will promote nerve regeneration by a combination of local stimuli delivered on demand, will sense inflammation, and will control the immune-inflammatory response. The biomedical impact of the project will be demonstrated in vitro and in vivo. In vitro, the neural therapeutic plasticity induced by the I-ONE device will be evaluated on stem cells, which will be differentiated to neural progenitor cells, and then to neural cells. In vivo, the study of neural plasticity will be transferred to endogeneous stem cells by implanting the I-ONE device into a contusion SCI animal model. I-ONE will acquire the knowledge and the technology required to regenerate the nerve in the niche of the injury.

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**NBR: 280773** **ACRONYM: NWS4LIGHT** **EC FUND: 3160400**

**DG:** RTD **Call: FP7-NMP-2011-SMALL-5** **Thema:** NMP.2011.2.2-3

**Title:** Nanowires for solid state lighting

**Abstract:** The suggested project aims at developing a nanowire (NW) technology applied to III-nitride and III-V materials to improve the present Solid State Lighting (SSL) solutions. Present white light emitting diode (LED) emitters are based on thin film III-nitride technology, and a combination of violet-blue LEDs and suitable phosphor coatings has yielded a light emission efficacy of >100 lm/W with an operating lifetime >50000 hrs in commercial white LEDs. The color rendering is generally unsatisfactory, however, and the cost is so far prohibitive for general market penetration. Our NW approach is based on combining three (blue-green-red) or four (blue-green-yellow-red) single NW LEDs into one white LED package, thereby avoiding the loss in the phosphor downconversion process. Using NW LEDs we also expect to increase the radiative efficiency due to a drastic reduction of the defect density in the active quantum well (QW) regions of the LEDs, and also improve the extraction efficiency of the emitted light. Our suggested employment of large size silicon or sapphire wafers as substrates is predicted to reduce the future fabrication cost by at least a factor 3. To increase the efficiency of white emitters it is necessary to drastically improve the LEDs emitting in the green-yellow part of the spectrum. We suggest to reach the green LED range by the ability to increase the In composition in the radial QWs of the presently grown nitride NW LEDs, and by using AlGaInP materials. The latter material system will also be explored for yellow and red NW LED emission. To realize yellow-red emission quantum dot media will also be employed, either by the SK growth mechanism on the m-plane facets of the NWs, or by separate application of InP/ZnS core-shell dots with red emission. To realize this work a consortium of five partners is suggested, comprising excellent expertise in growth of

NWs and in sophisticated studies of structural, electronic and optical properties of the NWs, and also processing into efficient LED structures having long life-times. The safety issues in the growth and handling of NWs are secured in collaboration with the Nano-Safety project at ULUND. The materials used are favorable from the environmental point of view.

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**NBR: 280778** **ACRONYM: MERIDIAN** **EC FUND: 3780000**

**DG:** RTD **Call: FP7-NMP-2011-SMALL-5** **Thema:** NMP.2011.1.4-4

**Title:** Micro and Nano Engineered Bi-Directional Carbon Interfaces for Advanced Peripheral Nervous System Prosthetics and Hybrid Bionics

**Abstract:** The main goal of this proposal is to bring novel technology of biocompatible, low bio-fouling, high electrochemical performance carbon nanomaterials to in-vivo preclinical applications and at the same time to use this materials to develop a highly advanced concept of intimate intracellular contact, based on bottom - up technology of, engulfing the micro-electrode by neural cells. Such bionic interfaces resemble true intrinsic physiological properties of neural somas and form a tight, extremely low-invasive bidirectional coupling for both motor and sensory functions. Advantage of our approach is unperfected fidelity of signals and resolution of single neuron fibers to be coupled to one protruding electrode. The research targets are devices ranging from cuff or lead electrodes to novel bidirectional interfaces for both sensory and motor functions for cybernetic mind-controlled prosthetics. Instead of re-targeting to an entire muscle, our research comes thus with a technique how to couple neurons by an intracellular way to form a single microelectrode-axon stimulating device and at the same time to provide sensory input , being on the front edge of research on bionic interfaces for novel neuroprosthetics. The proposed technology takes advantage of unique properties of well established nanodiamond thin films, with their unique and the simple carbon chemistry allowing integration with antibactericidal and anti-inflammatory surfaces. MERIDIAN will demonstrate devices in in-vivo studies and in preclinical tests on humans and benchmark fabricated devices with the current state of the art bionic system on the market.

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**NBR: 280779** **ACRONYM: SMART-NANO** **EC FUND: 3495300**

**DG:** RTD **Call: FP7-NMP-2011-SME-5** **Thema:** NMP.2011.1.3-1

**Title:** Sensitive MeAsuRemenT, detection, and identification of engineered NANOparticles in complex matrices

**Abstract:** SMART-NANO will develop an innovative, cost-effective technology platform that provides a total solution "from sample-to-result" for the detection, identification, and measurement of nanoparticles in complex matrices in Consumer Products, in Food, in the Environment and in situ in Biota. A key innovation is the miniaturized, application-specific, cartridge-based system integrating separation, detection, and quantification. On top of this CORE innovation, plug-in modules for sample preparation, high sensitivity size measurement, and hypersensitive identification, provide the necessary sensitivity and flexibility to this technology platform. Highly innovative approaches also lie in the supercritical CO2 isolation of Engineered Nanoparticles (ENPs) from complex matrices and the ICP-MS based hypersensitive identification of ENPs. A practical approach based on the development of the technology platform together with the development and field testing of methods and protocols will result in ready-to-use, cost-effective cartridges for immediate, widespread use in applications for real life detection and measurement of Engineered Nanoparticles. The consortium is led by a non-profit research organization whose mission is to transfer technological innovation to the market (CSEM), has a strong participation of a supernational research center whose mission is to provide scientific support to EU policy makers (JRC), includes five SMEs (FeyeCon Carbon Dioxide Technologies, Postnova Analytics GmbH, Avid Nano Ltd, AHAVA Dead Sea Laboratories Ltd, ABICH S.r.l.) and a public research organization (Ruđer Bošković Institute) with a track record of excellence and innovation in the different analytical steps necessary to carry out the isolation, separation and measurement of nanoparticles in complex matrices. The SMART-NANO consortium has thus the required vision and experience to successfully execute this innovative project.

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**NBR: 280786** **ACRONYM: ECLIPSE** **EC FUND: 3725000**

**DG:** RTD **Call: FP7-NMP-2011-SMALL-5** **Thema:** NMP.2011.2.3-1

**Title:** RENEWABLE ECO-FRIENDLY POLY(LACTIC ACID) NANOCOMPOSITES FROM WASTE SOURCES

**Abstract:** Poly(lactic acid) (PLA) is a compostable polymer derived from renewable food-derived sources (mainly starch and sugar beet) and possesses the highest potential for a commercial major scale production of renewable packaging materials. Since PLA is compostable and derived from sustainable sources, it can be envisaged as a promising material for the reduction of the enormous societal problems associated to solid waste disposal. ECLIPSE promotes a more sustainable and environmentally friendly approach to packaging, via the use of waste derived materials unrelated to fossil fuels and to the food chain. The main objective of ECLIPSE is to revalorize waste-derived products (algae biomass waste and plant and crustacean wastes) into novel packaging materials. The ECLIPSE approach intends to revalorize waste materials for the production of an algae-derived PLA matrix. In addition, ECLIPSE also seeks to reinforce such PLA matrix with functionalized nanofillers extracted from non-edible banana plant, almond shell and

crustacean shell wastes. This project aims at decreasing both the production costs of both poly(lactic acid) and algae biodiesel, by increasing the added value of algae waste via its revalorisation into the production of lactic acid. To this purpose, the industrial partnership was designed to combine leading companies to supply the raw materials involved in the project, namely algae (ALGAENERGY), lactic acid (GALACTIC), PLA (FUTERRO), banana waste (BANACOL) and seafood waste (ANTARTIC), with sound research groups active on biopolymers and nanoparticle functionalisation and dispersion (UMONS, CIDETEC, FRAUNHOFER, LTU, UPV/EHU, UPB, PUC) and a global end user with multiple plastic packaging converting facilities. This consortium includes 9 partners from European institutions and 4 partners from South American SICA countries, all of them experts in their respective fields.

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**NBR: 280804** **ACRONYM: LANIR** **EC FUND: 4150000**

**DG:** RTD **Call: FP7-NMP-2011-SME-5** **Thema:** NMP.2011.1.4-3

**Title:** Label Free Nanoscopy Using Infra Red

**Abstract:** Every year, Alzheimer's disease (AD) affects about 800,000 new patients in Europe and directly causes 50% of dependency of aged persons. Currently there is no test to diagnose this disease. There is a great need to improve outcomes for patients with lung cancer which causes between 15-28% of all cancer deaths in Europe. Chemical and structural imaging with nanoresolution under ambient conditions can significantly advance our understanding of biological processes at the sub-cellular level and provide understanding of early stage AD and lung cancer, improve the efficacy of therapeutic drugs and evaluate the real impact of nanomaterials to health and safety. In production processes the ability to image defects with nanometre resolution is critical for robust quality control of 'industrially important' products e.g. organic photovoltaic devices, antimicrobial textiles and functional coatings on biomedical implants. Nanoscale imaging available today does not permit in situ sub-cellular analysis and integrated metrology. This restricts our ability to optimise nanomaterials processes. Vibrational spectroscopy based imaging tools such as Infra-Red microscopy can provide a solution. Lateral resolutions of such techniques are currently limited to the micrometre range due to diffraction-limits. This project proposes a novel imaging tool Infra Red Nanoscope (IRN) that will break away from this diffraction limit. IRN will significantly improve the lateral resolution of IR microscopy on a table-top set up from the current state-of-the-art of 100 micron to 70 nm. It will also perform 3D imaging at a resolution of 500 nm, which is currently not possible in IR microscopy. A detailed methodology and instrumentation plan exists to implement a ready to commercialise table-top, nanoresolution, IRN. The instrument offers easy operation, flexibility and label free imaging of structure and chemistry that will stimulate new research in cancer treatments and early stage diagnostics of AD.

**NBR: 280879** **ACRONYM: CRONOS** **EC FUND: 3380058**

**DG:** RTD **Call: FP7-NMP-2011-SMALL-5** **Thema:** NMP.2011.2.1-2

**Title:** Time dynamics and ContROl in naNOStructures for magnetic recording and energy applications

**Abstract:** The CRONOS project seeks to develop a quantitative, flexible and fully atomistic theory of ultrafast dynamics in real materials. Our effort will create the necessary knowledge for advancing two technological areas crucial for the economic future of Europe and the well being of its citizens: new materials for solar energy harvesting and ultra-high density magnetic data storage. In particular we will construct the necessary theoretical tools for addressing the problems of energy photo-conversion and laser-induced ultrafast magnetization dynamics. Crucially CRONOS will not just look at how an optical excitation perturbs a materials system but also at how such an excitation can be engineered to produce a desired response. Hence both the direct and the inverse problem will be tackled. CRONOS' theoretical program will be validated by a broad experimental activity on ultra-fast pump-probe spectroscopy and by the presence in the consortium of European companies. Equally important is the fact that the consortium will produce a substantial amount of high-end scientific software, which will then be distributed freely to the academic community. The project will develop a quantitative and materials-specific theory for electron dynamics in nano-structures, which, at the same time, is fully atomistic, efficient, scalable to large systems, and rigorously theoretically formulated. The core of our method is time-dependent density functional theory, TDDFT, which was invented by a member of our consortium and has been developed over the years . Our workplan comprises formal methodological development, algorithm implementation, applications to both solar cells and magnetic recording, and experimental validation. A significant deliverable of this project will also be the wide distribution of computational packages

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**NBR: 280890** **ACRONYM: NEXT-GEN-CAT** **EC FUND: 3938298**

**DG:** RTD **Call: FP7-NMP-2011-SMALL-5** **Thema:** NMP.2011.2.2-4

**Title:** Development of NEXT GENeration cost efficient automotive CATalysts

**Abstract:** The main objective of NEXTGENCAT proposal is the development of novel eco-friendly nano-structured automotive catalysts utilizing transition metal nanoparticles (Cu, Ni, Co Zn, Fe etc) that can partially or completely replace the PGMs. Based on nanotechnology, low cost nanoparticles will be incorporated into different substrates, including advanced

ceramics (SiO2, perovskite etc) and silicon carbides, for the development of efficient and inexpensive catalysts. The main idea of the proposal is the effective dispersion and the controllable size of the metal nanoparticles into the substrate that will lead to improved performance. To this end a modified polyol process as well as chemical and physical treatment of selected substances will enable the introduction of transition metal nanoparticles on the catalyst substrate precursors via adsorption and ion-exchange. The presence of metal ions sorbed on fixed precursor sites will inhibit the agglomeration during heating and final products with very fine particle dispersion and tuneable metal content will be obtained. It is expected that the developed catalysts will exhibit increased catalytic performance, even at low temperatures (200-250oC). Other key properties of the proposed nanostructured catalysts include: increased thermal stability (avoiding aggregation), improved durability, capability of reuse and recovery of transition metals as well as low health and environmental impact. Apart from the scientific innovations and the environmental impact, the proposal holds also great economic importance. Taking into account that the autocatalyst industry uses extremely large quantities of precious metal-68% of Pt and 72% of Pd in Europe – the impact of replacing PGMs is of tremendous significance. Based on the current metal prices, it is estimated that the developed catalysts will reduce the catalyst cost at about 40-50%, opening the way to an efficient adaptation of nanotechnology-based catalysts in the automotive sector.

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**NBR: 280909** **ACRONYM: CERAWATER** **EC FUND: 2808105**

**DG:** RTD **Call: FP7-NMP-2011-SMALL-5** **Thema:** NMP.2011.1.2-3

**Title:** Fouling resistant ceramic honeycomb nanofilters for efficient water treatment

**Abstract:** The main challenge of the proposed project is the development of a ceramic honeycomb nanofiltration membrane with strongly increased membrane area of up to 25 m². The strongly increased membrane area in comparison with existing ceramic membranes for nanofiltration in combination with a high surface to volume ratio shall be competitive with polymeric membranes in terms of economics. The nanofiltration coating will allow for instance the direct filtration of surface water for drinking water preparation by a “low volume, low energy” filtration process. The low fouling tendency of the ceramic material will lead to low operating costs and reduced membrane down time during membrane cleaning. The high mechanical stability enables high pressure back-flushing of the membranes. The high chemical and thermal stability of the membrane material allows the chemical or thermal regeneration and sterilization by aggressive chemicals or hot steam if needed. Furthermore ceramic membranes shows considerably higher permeate fluxes in comparison to polymeric membranes. In addition to the high permeability and a low fouling tendency the membranes can be operated at low transmembrane pressures and low cross flow velocities. This strategy helps to reduce operation costs and save energy (“low feed, low pressure”). The proposed project will

address a crucial point in terms of a more extended use of membrane filtration technologies in water purification: the ratio between active filtration surface and module size. Besides overall ordinary requirements in membrane filtration like long term stability, appropriate membrane price, high selectivity, high flux/pressure ratio, low energy demand for cross-flow-filtration and low membrane cleaning frequency this parameter will be of vital importance for the implementation of ceramic membrane technique in a large scale.

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**NBR: 280915** **ACRONYM: PULMOSTENT** **EC FUND: 3167699**

**DG:** RTD **Call: FP7-NMP-2011-SMALL-5** **Thema:** NMP.2011.2.2-2

**Title:** Development & Evaluation of a Viable Stent Device for the Treatment of BronchoTracheal Cancer

**Abstract:** Lung cancer is the most common cancer in terms of both incidence and mortality, worldwide. With a median age at diagnosis of 71, lung cancer is mainly affecting the aging population. Airway stenosis is a key problem with significant morbidity and premature death. Endobronchial stenting is a proven therapy to keep the airways open. Nevertheless the currently used clinical stents have major disadvantages either by rapid re-occlusion due to tumour ingrowths (metal stents) or massive mucus retention due to the interrupted mucociliary function (coated stents). The aim of the project is to develop a viable endobronchial stent (syn. PulmoStent) for the treatment of broncho-tracheal cancer diseases. The concept is based on the combination of stent technologies with the principles of tissue engineering. The PulmoStent is a multi-layered structure providing (1) a functional respiratory epithelium on the luminal side, which allows the maintenance of the mucociliary function in the stented area, (2) an embedded micro- or nanosphere formulations, enabling the sustained, local release of tumour-specific therapeutics in combination with (3) a mechanical separating layer on the external side, enabling a local tumour suppression to avoid stent displacement and restenosis by a growing tumour. The PulmoStent is a step change beyond the state-of-the-art from a passive to a viable and functional active implant tailored to the patient. It focuses on a clearly identified clinical need for the treatment of lung cancer. The combination of different kinds of biomaterials to a co-scaffold system for the bio-functionalization of the stent will lead to an improved performance of endobronchial stents and thereby to longer durability. The novel PulmoStent will improve the quality of life and increase the life expectancy of lung cancer patients, because of the reduced mucus retention in the stented area, and herewith the reduced risk of life-threatening pneumonia and the local tumour suppression.

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**NBR: 280983** **ACRONYM: SHYMAN** **EC FUND: 6863305**

**DG:** RTD **Call: FP7-NMP-2011-LARGE-5** **Thema:** NMP.2011.1.4-1

**Title:** Sustainable Hydrothermal Manufacturing of Nanomaterials

**Abstract:** It is vital that nanomanufacturing routes facilitate an increase in production whilst being 'green', sustainable, low cost and capable of producing high quality materials. Continuous hydrothermal synthesis is an enabling and underpinning technology that is ready to prove itself at industrial scale as a result of recent breakthroughs in reactor design which suggest that it could now be scaled over 100 tons per annum. Academic specialists with international reputations in reactor modelling and kinetics and metrology will develop the 'know how' needed to scale up the current pilot scale system. Selected project partners with expertise in sustainability modelling and life cycle assessment will quantify the environmental impact and benefits of a process that uses water as a recyclable solvent, whilst producing the highest quality, dispersed and formulated products. In addition to scale up production, the process will be improved through case studies with industrial end users in four key areas – printed electronics with SOVY; surface coatings with CRF, PPG and SOVY; healthcare and medical with ENDOR and CERA; hybrid polymers and materials with ITAP, TopGaN and REPSOL. Further value will be added to the Project by working on new materials that have been identified as key future targets but cannot be currently made, or made in significant quantities. The consortium is founded on the principle that the whole value chain (from nanoparticle production to final product) must be involved in the development of the technology. This will not only inform the development stages of the production process but also maximise 'market pull', rather than simply relying on subsequent 'technology push'.

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**NBR: 280987** **ACRONYM: NANOXCT** **EC FUND: 3100000**

**DG:** RTD **Call: FP7-NMP-2011-SME-5** **Thema:** NMP.2011.1.4-3

**Title:** Compact X-ray computed tomography system for non destructive characterization of nano materials

**Abstract:** Within the past decades, advances in miniaturization from micro to nano-scale have had dramatic impacts on our lives. Consumer electronics, which once occupied large volumes, now fit in the palm of a hand. But nanotechnology does not only improve in electronics. Also material sciences, chemical engineering, or biology are strongly profiting from nanotechnology. The tremendous achievements in all of these areas would not have been possible without the material analytics in behind. Material analytics for nano-scale characterization currently covers destructive methods, surface inspection methods, or 2D methods. To date it is not possible to get a comprehensive representation of a specimen including internal and external 3D-structure analysis as

well as a chemical analysis without destroying the probe. In this respect nano-scale material analytics is currently on the edge of a new era, which is targeted in NanoXCT. The project addresses the limitations of conventional techniques using 3D X-ray computed tomography, which allows for non destructive and fully three dimensional characterizations of specimens. In order to facilitate X-ray computed tomography at the nanometer scale, NanoXCT comprises a novel concept of an ultra-bright X-ray source in combination with a high precision focusing and emission system. Furthermore, a highly sensitive, photon counting wide field of view small pitch X-ray detector concept will be included. The concept is perfected by a high precision manipulation system, which allows for alternative scanning geometries as helical CT, and a suitable software environment for data processing and analysis. NanoXCT links the activities of 11 partners from 7 European countries including 5 SMEs to design, develop and implement a desktop X-ray computed tomography system for non destructive characterization of nano materials and components. The targeted specifications yield a wide field of view of 1mm, a probe size of up to 1mm² and a voxel size of 50 nm.

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**NBR: 280995** **ACRONYM: CERAMPOL** **EC FUND: 3463889**

**DG:** RTD **Call: FP7-NMP-2011-SMALL-5** **Thema:** NMP.2011.1.2-3

**Title:** CERAMIC AND POLYMERIC MEMBRANE FOR WATER PURIFICATION OF HEAVY METAL AND HAZARDOUS ORGANIC COMPOUND

**Abstract:** The main objective of the CERAMPOL project is to achieve a new generation of smart and low-fouling nanostructured membranes based on ceramic and polymeric materials with enhanced affinity to heavy metals and drugs. CERAMPOL will contribute in solving issues related to waste water in metallurgic and pharmaceutical industries/hospital respectively. Moreover, by reducing the concentration of highly toxic contaminants in the water supplies, lakes, rivers, and streams, the new filtration technology developed in the CERAMPOL project will mitigate the risk to humans' health and the environment such as bioaccumulation of heavy metals, the emergence of multidrug resistance organisms, chronic toxicity, and metal-related diseases. The new filters will be prepared by innovative processes such as electrospinning, sol-gel, coating processes for obtaining multi-layered membranes possessing several key properties such as: antifouling; self-cleaning; selective filtration of antibiotics and heavy metals. Specifically, the multi-layered membranes will composed of three functional parts CERAMPOL functional parts: an anti-fouling pre-filter based on polymeric nanofibers, a cleaning system based on piezoelectric materials, and a highly selective nanostructured ceramic membrane. The new filters will be scaled up at semi industrial level for in-situ water treatments in foundry, pharmaceutical and hospital effluents. The benefits of such technology will be fully characterized in terms of water filtration efficiency and economic and environmental impacts. Complete technological and economical viability assessments of the CERAMPOL technology will be carried out by the industrial partners. Environmental

impact caused by the new filtration technology will be fully assessed in order to highlight benefits in terms of water preservation and recovering.

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**NBR: 281027** **ACRONYM: CLEAN4YIELD** **EC FUND: 7060000**

**DG:** RTD **Call: FP7-NMP-2011-LARGE-5** **Thema:** NMP.2011.1.4-2

**Title:** Contamination and defect control for increased yield for large scale R2R production of OPV and OLED

**Abstract:** While nanotechnology was originally limited to small areas of a few cm2, the quest for lower costs has been the latest years the drive for developing processes utilising larger substrate sizes at increasing throughputs. A typical example is the flat panel display industry where the push to larger gen size and faster processing has resulted in a significant cost reduction. The next challenge here is the move to smaller feature sizes. Large area processing at high speeds is optimal when using roll-to-roll (R2R) processing, able to deliver the ultimate cost reduction. Flexible innovative thin film devices, like organic light emitting diodes (OLEDs) for lighting, photo voltaic (PV) and organic photo voltaic (OPV) modules, organic circuitry, printed electronics and thin film batteries, are currently developed using this kind of processing. The overall objective of Clean4Yield is the development and demonstration of technologies and tools for nano-scale detection, cleaning, prevention and repair of defects and contaminations in nano-scale layers. The R2R production processes for OLED, OPV, and high-end moisture barrier layers on flexible substrates will serve as development platform for the various methods. Clean4Yield will demonstrate that the developed methods increase yield, reduce production costs, and improve performance and operational device lifetimes of these applications. The developed technologies will be easy to adapted for other large-scale production technologies of other nano layer applications.

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**NBR: 281035** **ACRONYM: TRANS-INT** **EC FUND: 8000000**

**DG:** RTD **Call: FP7-NMP-2011-LARGE-5** **Thema:** NMP.2011.1.2-2

**Title:** New Oral Nanomedicines: Transporting Therapeutic Macromolecules across the Intestinal Barrier

**Abstract:** Despite the increasing number of macromolecules with potential impact in the treatment of devastating systemic diseases, these therapies have failed to deliver on their expectations because they cannot be administered in the fashion which is most cost efficient and has the highest patient compliance: the oral route. The availability of an oral form of administration could lead to a great improvement of classical therapies

and it would also make a high number of new therapies feasible. To make this happen, the final objective of Trans-INT is to design nanocarriers specifically adapted to deal with the gastrointestinal ecosystem and use them for the development of new oral nanomedicines for diseases with high socioeconomic impact (i.e. metabolic diseases, pain medication). The concept behind TRANS-INT is the rational design of oral nanomedicines based on safety, mechanistic, bioengineering (multifunctional nanocarriers: high payload, drug protection, efficient drug transport, controlled release) and pharmaceutical technology criteria (scalable technology and stability). The project will start with nanocarrier platforms on which the partners have IPR and freedom to operate: nanocapsules, nanoparticles, micelles made of combinations of lipids, polypeptides and polysaccharides, continue with the optimization and redefinition of selected nanocarriers. It is expected to end with (i) at least one oral nanocarrier prototype with a comprehensive GLP-tox package, which could be applied for the delivery of a high number of peptide molecules, (ii) at least one nanomedicine fulfilling target product profile criteria, with a comprehensive preclinical evaluation package, (iii) substantial integrative knowledge on the feasibility and potential of oral nanocarriers and nanopharmaceuticals. TRANS-INT is expected to have a great impact no only from the new therapies/patients perspective but also from the innovation and EU industrial development perspective.

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**NBR: 281043** **ACRONYM: FEMTOSPIN** **EC FUND: 3999600**

**DG:** RTD **Call: FP7-NMP-2011-SMALL-5** **Thema:** NMP.2011.2.1-2

**Title:** Multiscale Modelling of Femtosecond Spin Dynamics

**Abstract:** Information storage technology is essentially based on nanostructured magnetic materials. Considerable research effort is aimed at increasing the density of stored information and this generally requires increasingly sophisticated media design to engineer the desired combination of low write field and thermal stability of recording information. An alternative approach is Heat Assisted Magnetic Recording in which a laser is used to heat the medium to a sufficiently high temperature to assure writability using currently available write head fields. Also a new, highly promising, development is that of spin electronics in which the spin of the electron rather than merely the charge forms the basis of the device operation. This holds the prospect of allowing technology to develop beyond the limits of miniaturisation of standard electronics and may yield the solution of the increasing power requirements for conventional electronic devices. However, the switching speeds are limited by precessional motion of the magnetic spins to hundreds of picoseconds. However, magnetic spins can be manipulated on the femtosecond timescale. However, the physics of the processes occurring on this timescale is poorly understood. The proposal aims to develop a multiscale approach to the theoretical understanding of femtosecond magnetisation processes and to make a critical comparison with experimental data. The overall goal of the project is to use this

understanding to optimise materials for ultrafast (femtosecond) reversal and to develop computational tools for future materials and device design.

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**NBR: 281047** **ACRONYM: LBLBRANE** **EC FUND: 3676443**

**DG:** RTD **Call: FP7-NMP-2011-SMALL-5** **Thema:** NMP.2011.1.2-3

**Title:** Regenerable active polyelectrolyte nanofiltration membranes for water reuse and metal/acid recovery

**Abstract:** The shortage of drinking water in many regions on the planet constitutes a real problem and hazard. The use of seawater, brackish water and wastewater for human consumption is not a new concept. In spite of the success of membrane technology in water reclamation, membrane separation systems suffer from a serious problem: membrane fouling. The main downside is an inevitabe increase in operation and maintenance costs as well as an adverse effect on the lifespan of the membrane (harsh cleaning treatment). LbLBRANE is an ambitious project ensuring competent input right from the membrane concept down to lab-scale production and optimisation before scaling-up in pilot plants for end users. LbLBRANE applies novel nanotechnology tools, namely the layer-by-layer (LbL) technology to develop a versatile and generic procedure for the fast fabrication of low-cost, stable, chemical-resistant polyelectrolyte membranes. The LbL technology is the way to go for a bottom-up nano-engineered membrane whereby the modification is performed stepwise in a controlled manner - the thickness can be finely tuned by the number of layers deposited, the architecture of the film can be compartmentalised by incorporating functional species (polyelectrolyte as well as nanoparticles with specific functions, such as antibacterial properties) and the morphology of the film can be modulated via the pH, charge density and type of polyelectrolyte pairs to create pore size (hence permeability) tailored according to the specific need of the membranes. Our concern is focused towards high performance, regenerable membranes which could be cleaned in-situ and hybrid membranes with extremely high flux with high permselectivity and mechanical robustness. The ultimate aim is towards implementation of LbL on large industrial scale, from module design and construction to end user, especially for water reuse and metal/acid recovery.

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**NBR: 281056** **ACRONYM: NANOCI** **EC FUND: 3599853**

**DG:** RTD **Call: FP7-NMP-2011-SMALL-5** **Thema:** NMP.2011.1.4-4

**Title:** Nanotechnology based cochlear implant with gapless interface to auditory neurons

**Abstract:** Over 60 million of citizens in the EU suffer from hearing loss with its associated restrictions. In severe cases, hearing can only be restored by surgically implanting a neuroprosthesis called cochlear implant, which directly stimulates the auditory nerve. The bottleneck for optimal stimulation is caused by the anatomical gap between the electrode array and the auditory neurons in the inner ear. As a consequence, current devices are limited through (i) low frequency resolution, hence poor sound quality and (ii), strong signal amplification, hence high energy consumption responsible for significant battery costs and for impeding the development of fully implantable systems. Recent findings indicate that auditory nerve fibres can grow under neurotrophin stimulation towards the electrodes, which opens the door to address all issues simultaneously. NANOCI aims at developing a neuroprosthesis with a gapless interface to auditory nerve fibres. The neurites will be attracted and guided by an innovative, nanostructured gel matrix containing diffusible and surface-bound neurotrophic compounds towards the functionalized, neurotrophic electrode array surface. The long-lasting operation without interface degradation, reduced biofouling and improved conductivity will be achieved by nanostructuring the array surface using (i) various functional nanomaterials, including carbon nanotubes, combined with (ii) structuration methodologies such as ion implantation and sacrificial nanoparticle embedding in parylene, SOLID (solid on liquid deposition) encapsulation, and sonochemistry. Components will be validated using appropriate bioassays including human auditory neurons in vitro. In parallel, software models will be developed to exploit the bidirectional, gapless interface. Fusing all developments, an animal-grade, pilot nanoCI-device is manufactured and tested in vivo. This will allow to assess the feasibility of a future, cost-efficient, and fully implantable neuroprosthesis with substantially increased sound quality.

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**NBR: 281098** **ACRONYM: SINGLEREPLISOME** **EC FUND: 2000000**

**DG:** ERCEA **Call: ERC-2011-StG_20101109** **Thema:** ERC-SG-LS1

**Title:** Under the hood: Single-molecule studies of the DNA replication machinery

**Abstract:** The study of biological processes at the single-molecule level has greatly influenced our view of the molecular mechanisms that define life. However, studies so far have mainly focused on individual, purified proteins in non-physiological environments. Since cellular processes are typically not mediated by single proteins, but rather by large complexes of dynamically interacting components, the development of the tools to study such large complexes with single-molecule sensitivity is an important direction. With our initial successes in developing the single-molecule tools to study DNA replication, we have begun to open the field of single-molecule biophysics to the study of large, multi-component complexes. Here we describe how we will develop new single-molecule approaches to study the physical interactions and molecular mechanisms that control the DNA replication machinery, both in simple model systems and in higher organisms.

By measuring the elastic properties of DNA and simultaneously visualizing fluorescently labeled replication proteins acting on the same DNA we will be able to relate the physical structure and composition of the replication complex to its mechanism of action. We will also develop the tools to study the replication machinery in cellular extracts of higher organisms; an environment that is compatible with our nanomanipulation and fluorescence tools, but faithfully mimics the complex environment in which these processes normally take place. Our objective is to arrive at a complete molecular understanding of how DNA replication works. We will use the tools described in this proposal to address a number of poorly understood issues: What is the mechanism of coupling between DNA unwinding and synthesis? How are the two DNA polymerases coordinated? How does replication deal with roadblocks on the DNA? Our approach to obtain "molecular movies" of the replication process represents an entirely novel strategy to understand these issues.

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**NBR: 281490** **ACRONYM: CELLCONTROL** **EC FUND: 1479008**

**DG:** ERCEA **Call: ERC-2011-StG_20101109** **Thema:** ERC-SG-LS9

**Title:** Synthetic regulatory circuits for programmable control of cell physiology

**Abstract:** The newly emerging discipline of Synthetic Biology holds the promise of radically changing the way we probe, control and augment living matter from single cells to entire organisms, and revolutionize basic biological research, biotechnology, and medicine. However, practical work toward these important goals is still in its infancy, in part because concrete approaches to achieve rational control of cell physiology are currently lacking. In order to advance this vision, here we propose a detailed strategy toward engineered regulatory circuits that read out complex cellular states based on multiple biological signals, and convert this information into a desired action based on pre-programmed signal integration. If successful, our strategy will enable unprecedented level of rational intervention with the cell. Specifically, we suggest to read out cellular information as relayed by expression and activity of cell's transcription factors, proteins that control gene expression and serve as major regulators of cell fate and cell response to transient stimuli. The readout will be accomplished with the help of specially-designed sensor promoters that will in turn drive the expression of engineered microRNA molecules. Those molecules in turn will converge on a small number of response elements in engineered downstream transcripts, implementing highly-flexible and programmable logic integration of the original transcription factor signals (Rinaudo et al, Nature Biotechnology, 2007 and Leisner et al, Nature Nanotechnology, 2010). We propose a stepwise bottom-up construction strategy whereby we first design, test and optimize sensor promoters for individual TFs, next we integrate them into large networks, and finally we show how to utilize these networks as prototype selective anti-cancer therapies. To validate our approaches, we will use human cancer cell lines as a model system.

**NBR: 281579** **ACRONYM: ENVNANO** **EC FUND: 1196260**

**DG:** ERCEA **Call: ERC-2011-StG_20101109** **Thema:** ERC-SG-LS9

**Title:** Environmental Effects and Risk Evaluation of Engineered Nanoparticles

**Abstract:** The objective of the project Environmental Effects and Risk Evaluation of Engineered Nanoparticles (EnvNano) is to elucidate the particle specific properties that govern the ecotoxicological effects of engineered nanoparticles and in this way shift the paradigm for environmental risk assessment of nanomaterials. While current activities in the emerging field of nano-ecotoxicology and environmental risk assessment of nanomaterials are based on the assumption that the methodologies developed for chemicals can be adapted to be applicable for nanomaterials, EnvNano has a completely different starting point: The behaviour of nanoparticles in suspension is fundamentally different from that of chemicals in on solution. Therefore, all modifications of existing techniques that do not take this fact into account are bound to have a limited sphere of application or in the worst case to be invalid. By replacing the assumption of dissolved chemicals with a particle behaviour assumption, the traditional risk assessment paradigm will be so seriously impaired that a shift of paradigm will be needed. EnvNano is based on the following hypotheses: 1. The ecotoxicity and bioaccumulation of engineered nanoparticles will be a function of specific physical and chemical characteristics of the nanoparticles; 2. The environmental hazards of engineered nanoparticles cannot be derived from hazard identifications of the material in other forms; 3. Existing regulatory risk assessment procedures for chemicals will not be appropriate to assess the behaviour and potential harmful effects of engineered nanoparticles on the environment. These research hypotheses will be addressed in the four interacting research topics of EnvNano: Particle Characterization, Ecotoxicty, Bioaccumulation, and Framework for Risk Evaluation of Nanoparticles aimed to form the foundation for a movement from coefficient-based to kinetic-based environmental nanotoxicology and risk assessment.

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**NBR: 282051** **ACRONYM: FORCEREGULATION** **EC FUND: 1998331**

**DG:** ERCEA **Call: ERC-2011-StG_20101109** **Thema:** ERC-SG-LS1

**Title:** How force regulates cell function: a molecular and cellular outlook

**Abstract:** Force is ubiquitous in nature and physical stimuli are crucial for cell function. How cells process forces determines key physiological processes such as cell growth and differentiation, in which cells divide or differentiate according to the chemical and

physical cues cells receive from the extracellular matrix. Physical stimuli have also been involved in the development of pathological processes, especially those in which cells lose the proper physical communication with the environment, such as cancer and metastasis formation. The major components of the mechanotransduction signaling pathways that transmit and translate these physical messages will most likely to be the molecules that directly sense force from the extracellular matrix. These molecules are integrins and the proteins that link them to the cytoskeleton. Here, I propose a multidisciplinary approach aimed to elucidate how force can modulate cellular behaviour. The project will focus on (i) determining how cells sense, produce and interpret forces and (ii) the cellular outcomes resulting from these processes. First, a nanotechnological suite composed of magnetic tweezers, and siRNA technology will be developed and employed to determine the roles of the molecules involved in these mechanical pathways. Second, the molecular mechanisms that trigger the interaction of proteins under force application will be studied. Several biophysical techniques such as magnetic tweezers, Atomic Force Microscopy (AFM), Total Internal Reflection Fluorescence (TIRF), and Fluorescence Resonance Energy Transfer (FRET) will be used here. Finally, a comparative study of the effect of force in normal and malignant cells will be accomplished. It will be tested whether or not these pathways are involved in the expression of genes in the nucleus, and the ability of normal and malignant cells to respond to external forces and to apply forces on their substrates. Magnetic tweezers, and elastic pillars will be used here.

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**NBR: 282101** **ACRONYM: IMPLANT** **EC FUND: 1487476**

**DG:** ERCEA **Call: ERC-2011-StG_20101109** **Thema:** ERC-SG-LS9

**Title:** Silicon transport proteins in biological nanoscience and synthetic biology

**Abstract:** This interdisciplinary proposal will investigate whether the activity of a unique family of membrane transport proteins can be harnessed to develop novel strategies for the bioinspired fabrication of nanoscale materials and provide new directions in synthetic biology. Silicon transporters (SITs) are integral membrane proteins that were first identified in the diatoms, single–celled eukaryotic algae that surround themselves with a cell wall of hydrated silica. The biosynthesis of this 'glass house' depends upon the uptake of silicic acid, the soluble form of silica, from the environment. The SITs bind silicic acid with high affinity and transport it across the cytoplasmic membrane into the cell. Under this proposal the SITs will be recombinantly expressed and purified before being reconstituted into synthetic liposomes. The resulting proteoliposomes will be energized to drive SIT-dependent transport of silicic acid into the interior lumen. Since the lumen has dimensions on the nanometer length scale and attolitre volume, the proteoliposomes will act as discrete nanoreactors for the synthesis of silica nanoparticles. Using SIT proteins to deliver silicic acid to the growing nanoparticle offers an unprecedented degree of tunable kinetic control over the synthetic conditions that,

together with the lumen microenvironment, may induce novel particle morphologies or properties. This principle will be extended in two further directions. First, encapsulating preformed inorganic nanoparticles in the liposome lumen will lead to the formation of core-shell nanoparticles with a functional core and passive silica shell. Using SITs to control the supply of the synthetic precursor will provide unparalleled tight control over the thickness of the silica shell. A second element will create a diatom protocell by incorporating silica-condensing peptides into the lumen in order to generate silica nanostructures. This will establish a unique new methodology for nanoscale synthesis.

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**NBR: 282105** **ACRONYM: LEC&LIP2INVADE** **EC FUND: 1436400**

**DG:** ERCEA **Call: ERC-2011-StG_20101109** **Thema:** ERC-SG-LS3

**Title:** The interactions of the Pseudomonas aeruginosa lectins LecA and LecB with glycosphingolipids result in membrane invagination, signaling and cellular uptake of the bacterium

**Abstract:** Pseudomonas aeruginosa has emerged as a major opportunistic pathogen during the past century. The invasion of host cells plays a fundamental role in the pathogenesis of this bacterium. As clinically important antibiotic resistance of P. aeruginosa continues to increase, the identification of host as well as microbial factors essential for P. aeruginosa uptake may lead to new drug targets. Our highly ambitious and interdisciplinary research project at the interface of biology, chemistry and physics aims at describing the molecular mechanism of the internalization of P. aeruginosa in non-phagocytic cells. Based on novel concepts that we have established for some bacterial toxins and animal viruses, we hypothesize that specific interactions of the P. aeruginosa lectins LecA and LecB with distinct glycosphingolipids exposed at the host cell surface lead to formation of plasma membrane invaginations, activation and recruitment of signaling molecules, cytoskeleton remodeling and cellular uptake of the bacterium. In order to acquire highly complementary results and to ensure the maximal outcome, we will perform our studies on diverse animal cells and various membrane model systems in combination with super resolution imaging techniques, biochemical and screening approaches. For the in vitro reconstitution of bacterial invasion, we will develop a unique platform for membrane nanoscopy based on planar pore-suspending membrane systems of different complexity (e.g. pore-suspending plasma membrane sheets and synthetic lipid bilayers). We expect to be able to identify key factors of bacterial uptake and small molecule inhibitors towards them in order to develop new therapies against the pathogenesis of P. aeruginosa infections.

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**NBR: 282312** **ACRONYM: NANOSYM** **EC FUND: 1444370**

**DG:** ERCEA **Call: ERC-2011-StG_20101109** **Thema:** ERC-SG-LS9

**Title:** Symbiotic bacteria as a delivery system for Nanobodies that target the insect-parasite interplay

**Abstract:** The tsetse fly (Glossina spp.) salivary gland is the final micro-environment where the Trypanosoma brucei parasites adhere and undergo a complex re-programming cycle resulting in an end stage that is re-programmed to continue its life cycle in a new mammalian host. The molecular parasite-vector communications that orchestrate this trypanosome development in tsetse fly salivary glands remain unknown mainly due to the limited availability of experimental tools for functional research. We hypothesize that an innovative paratransgenic approach using the Sodalis glossinidius endosymbiont to deliver Nanobodies that target the trypanosome-tsetse fly crosstalk will open a new avenue to unravel the molecular determinants of this specific parasite-vector association. In this project I will develop an innovative Sodalis-based internal delivery system for Nanobodies to target the tsetse fly – trypanosome interplay and, as final outcome, will generate a trypanosome-resistant tsetse fly. In addition, I will explore the completely 'unknown' of the molecular nature of trypanosome adherence to the salivary gland epithelium. This will be addressed by a challenging proteomic-based approach on the tsetse salivary gland - trypanosome membrane complex and by the newly developed paratransgenic approach using the S. glossinidius endosymbiont as an internal delivery system for salivary gland epithelium-targeting Nanobodies. The application of this innovative concept of using pathogen-targeting Nanobodies delivered by insect symbiotic bacteria could be extended to other vector-pathogen systems such as Anopheles gambiae – Plasmodium falciparum and Aedes aegypti – dengue virus.

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**NBR: 282693** **ACRONYM: ORION** **EC FUND: 2978002**

**DG:** REA **Call: FP7-SME-2011** **Thema:** SME-2011-2

**Title:** ORganic waste management by a small-scale Innovative automated system of anaerobic digestION

**Abstract:** Restaurants, hotels, markets, fisheries and other small to medium size agro-food industries have to manage 239 million tonnes of organic waste in Europe per year. The specific management of such waste, with respect to the legislative regulations of EU, involves costly treatment for SMEs and potential hygiene issues on site. ORION aims at allowing a vast majority of SMEs to manage their organic waste by themselves in order to decrease their treatment costs (storage, transport, landfill or incineration) and increase on-site hygiene conditions. Wastes will be also valorised as biomass to produce energy and increase SME autonomy and profitability. ORION main objectives consist of:
Ø Developing for the first time anaerobic digestion machine at the SME scale (1 m3 to 50 m3) that will combine effectiveness for a large range of organic wastes and reduced

capital and operating costs. Ø Developing advanced control tools and sensors to reach an optimum reliability Ø Increasing know-how on the impact of nanostructured surfaces on bacterial growth and increase waste throughput in the digestor Ø Developing a dissemination and training strategy in order to address a vast community of SMEs and offer them a personalized service Ø Contributing to the implementation of EU policies on waste management and renewable energies production. A maximum autonomy, adaptability and reliability are targeted. The digester is expected to be very cost-effective for users. ORION partnership is composed of European and National IAG representing the targeted sectors: fishery/aquaculture, hotel-restaurants, small agro-food industries and a Core Group of representative SME partners involved in the pilot design ND testing with various waste qualities and quantities. They will rely on a interdisciplinary group of research centers in order to achieve the technical goals of the project.

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**NBR: 282816** **ACRONYM: NANOFORART** **EC FUND: 2914676**

**DG:** RTD **Call: FP7-ENV-NMP-2011** **Thema:** ENV-NMP.2011.2.2-5

**Title:** Nano-materials for the conservation and preservation of movable and immovable artworks

**Abstract:** The main objective of the NANOFORART proposal is the development and experimentation of new nano-materials and responsive systems for the conservation and preservation of movable and immovable artworks. While the progress in material science has generated sophisticated nanostructured materials, conservation of cultural heritage is still mainly based on traditional methods and conventional materials that often lack the necessary compatibility with the original artworks and a durable performance in responding to the changes of natural environment and man-made activities. The main challenge of NANOFORART is the combination of sophisticated functional materials arising from the recent developments in nano-science/technology with innovative techniques in the restoration and preventive conservation of works of art, with unprecedented efficiency. The research activity will be focused on the development of manageable methodologies, based on nanosized structures and with a low environmental impact. The main tasks include the production of dispersions of nanoparticles, micellar solutions, microemulsions and gels, in order to offer new reliable pathways to restore and preserve works of art by combining the main features and properties of soft and hard-matter systems for cultural heritage conservation and preservation. In the second part of the project great importance will be given to technology transfer to SMEs that will play an important role in the standardization of applicative protocols, in the up-scale and commercialization of technology and in the evaluation of the eco-toxicity of nano-materials. A fundamental part of the project is also related to the role of end-users. Important museums, such as the National Museum of Anthropology and History of Mexico City and the National Museum of Denmark, will

validate the technology and the methods developed in the first part of the project, and provide training activities and dissemination of the developed techniques.

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**NBR: 282992** **ACRONYM: HEROMAT** **EC FUND: 2592189**

**DG:** RTD **Call: FP7-ENV-NMP-2011** **Thema:** ENV-NMP.2011.3.2.1-1

**Title:** PROTECTION OF CULTURAL HERITAGE OBJECTS WITH MULTIFUNCTIONAL ADVANCED MATERIALS

**Abstract:** The multidisciplinary research project will be directed towards the development of innovative environmental friendly materials with value added functions aimed to the protection of immovable Cultural Heritage assets. This project will cross-link an expert Pan-European team from the UK, Italy, Slovenia, Serbia and Russia, including experienced researchers and active participation of industrial partners - SME. The coordinated team work will be focused on the two historical objects located in urban (Serbia) and rural (Slovenia) environment, both having continental climate. The HEROMAT project investigation involves the chain of activities from the synthesis, establishment of the methodology for characterization and testing of novel protective materials through their pilot production and, finally, to the in situ application and monitoring on selected historical buildings, giving also their life cycle assessment. The outputs of this project will be a set of novel materials applicable for the protection of different inorganic mineral substrates providing multiple added functions: consolidation, self-cleaning and anti-microbial effect. The first layer will provide appropriate consolidation of the historical material, while the second layer will serve for its efficient protection. Additionally, the novel materials as a whole will possess good water vapor permeability. The connection between built-in and new materials will be realized through novel photocatalytic nanocomposites, anionic clays (layered double hydroxides) associated to TiO2 and/or other semiconductors. Therefore, the overall goal of the proposed project is the improvement of the physical state as well as the resistance to degradation of the monuments sustaining the functionality and the aesthetic appearance through a long period of time. The HEROMAT project will contribute to an effective, long-lasting solution, keeping the authenticity of the cultural assets and having socio-economic benefits.

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**NBR: 282998** **ACRONYM: PANNA** **EC FUND: 2136495**

**DG:** RTD **Call: FP7-ENV-NMP-2011** **Thema:** ENV-NMP.2011.2.2-5

**Title:** Plasma And Nano for New Age â€œsoftâ€• conservation

**Abstract:** The main objective is to develop a novel atmospheric plasma technique for surface cleaning and coating deposition as well as two innovative coatings: a self-diagnostic protective coating and a coating provided with identification marker. The project aims at integrating the new plasma cleaning/deposition technique and the new coatings in a "full-life" protocol spanning surface cleaning and pre-treatment, deposition of protective and identification coatings, and complete removal of coatings. The plasma technique is proposed for surface cleaning and coating removal as alternative or complementary to the other non-contact techniques such as laser. This technique is characterized by no thermal heating, selectivity, chemical reduction of oxides, applicability on all substrates and competitive costs. The self-diagnostic coatings provide a long-lasting solution with an added value of easy and instant diagnostic of coating functionality through a nano-technological approach, reducing monitoring costs and time with no impact on tourist accessibility. The identification marker coating allows using nanotechnologies to obtain a transparent authenticity proof and cataloguing label. The compatibility of the new materials with the substrates is guaranteed intrinsically by their integration in the "full-life" protocol because it ensures its complete reversibility. The protocol is applicable on all substrate materials principally as preventing conservation, in the project its validation is proposed on metal substrates (silver and bronze) and on mural paintings, limestone and sandstone. The project also aims at implementing a demonstrator of the entire "full-life" protocol, which will be used for training cultural operators in organised events and fairs. An added value is also the strong participation of SME's as conservation operators and as technological companies, which ensures the possibility of scaling up and placing the new products on the market.

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**NBR: 283077** **ACRONYM: IOLICAP** **EC FUND: 3978128**

**DG:** RTD **Call: FP7-ENERGY-2011-1** **Thema:** ENERGY.2011.5.1-1

**Title:** Novel IÎŸnic LÎ™quid and supported ionic liquid solvents for reversible CAPture of CO2

**Abstract:** The current requirements of the Post Combustion CO2 Capture (PCC) technology are: a) Reducing the parasitic energy load, b) Effectively addressing corrosion, c) Faster absorption/stripping rates, d) Less viscosity and less use of water, e) Confronting the problem of solvent degradation and volatility. These problems pose stimulating challenges for the synthesis of new solvents, aided by detailed molecular modeling of sorbate/sorbent interactions, and for new integrative module designs that enable their effective implementation in a process environment. In this context the IOLICAP proposal gathers expertise and skills form the domains of chemical synthesis of Ionic Liquids (ILs), molecular simulation/mechanical statistics, phase equilibrium, electrochemistry/corrosion, physicochemical/thermophysical characterisation, nanoporous materials & membrane technology and process engineering, aiming at the development and evaluation of novel Task Specific Ionic Liquid (TSILs) solvents that (a) short-term could replace the alkanolamines in currently existing PCC installations and (b)

long-term would lead to the establishment of a novel CO2 capture process, based on hybrid absorption bed/membrane technology that will incorporate TSIL modified porous materials and membranes. Task Specific Ionic Liquids exhibit enhanced CO2 capture capacity, which is above the 0.5 mol/mol limit of the currently applied amine solvents. Due to the high number of possible IL structures that will be synthesised during the project and the easy tuneability of their chemical and physical properties it is expected that loading capacities above the threshold of 1 mol/mol will be achieved. In addition, ILs are less corrosive than amines and are dissociated so there is no need for using large quantities of water. ILs are also less volatile and less sensitive to flue gas impurities a fact that ensures less need for timely injection of fresh solvent. The aforementioned properties which will be studied and verified during the project, will have a high impact on the energy intensity of the capture process since they can lead to a significant reduction of the Scrubber/Stripper units size and consequently of the parasitic energy load. Ionic Liquid membranes are lately examined as candidates for CO2/N2 separation exhibiting performances that are above the boundary limit of a Roberson plot for this separation. IOLICAP project targets at the optimisation of the stability, selectivity (200), flux properties (1000-2000 Barrers) and production cost of Task Specific Ionic Liquid membranes and at the further enhancement of the process efficiency, through a combination of membrane technology with bed adsorption. Membrane technology is the less energy intensive candidate for CO2/N2 separation since there is no need for regeneration and constitutes a much more versatile and economically feasible technology especially for applications in energy intensive industry like the cement, steel and refineries.

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**NBR: 283110** **ACRONYM: IMAT** **EC FUND: 1807545**

**DG:** RTD **Call: FP7-ENV-NMP-2011** **Thema:** ENV-NMP.2011.2.2-5

**Title:** INTELLIGENT MOBILE MULTIPURPOSE ACCURATE THERMOELECTRICAL (IMAT) DEVICE FOR ART CONSERVATION

**Abstract:** The IMAT project aims to integrate the cutting edge research in nanotechnology with that of cultural heritage conservation for the development of new advanced conservation techniques and materials. A consortium of researchers representing expertise in the areas of art conservation, nanotechnology, and thermo-electrical engineering, has been assembled with the purpose of inventing an advanced precision heating technology and designing a series of portable, highly accurate flexible mild heating devices specifically for broad application in the field of art conservation, employing, but not limited to the new technology of carbon nanotubes (CNT). The new technology and product acknowledges and responds to a glaring omission in fundamental conservation instrumentation. The control over the application of heat often constitutes the core of success in structural treatment of diverse cultural heritage objects, yet sources currently available to conservators are unable to guarantee

accuracy, control or uniformity, and therefore may compromise the favourable outcome of treatment. The lack of mobile high precision and accessible instrumentation impacts conservation treatment capacities and the long-term preservation of irreplaceable cultural heritage in the most direct way, since objects may be and are exposed to risk because of inadequate or unavailable instrumentation. This is particularly relevant to treatments that take place in the field, including emergency responses, that often must rely on inadequate tools. The heating table, long considered a basic piece of laboratory equipment for previous methodologies, is now out of sync with the current direction of conservation that favours minimally invasive treatments with respect to those of the past and requires enhanced mobility and versatility. The IMAT goals therefore will hit the core of this problem in many ways and the results will have a lasting impact on conservation methodology and beyond. The unique properties of carbon nanotube (CNT) materials will allow for the design of thin, lightweight, even transparent, stretchable and woven mild heaters with low power needs as an ultra-portable, versatile and efficient alternative for diverse thermal treatments. The development of the IMAT device and methodology will represent a unique opportunity to impact the field of conservation of heritage products in a significant manner, and the full extent of the potential for application will become evident only during the execution of the three-year project. Further application of the technology to fields outside of art conservation, such as art transportation, medical field, aeronautics, car industry, apparel industry and more will be investigated. The project was conceived with a research-based objective, focusing on the creation of the IMAT device in order to improve the quality, accessibility and cost effectiveness of a fundamental tool for art conservators in Europe and globally.

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**NBR: 283182** **ACRONYM: NANOMATCH** **EC FUND: 2522798**

**DG:** RTD **Call: FP7-ENV-NMP-2011** **Thema:** ENV-NMP.2011.3.2.1-1

**Title:** Nano-systems for the conservation of immoveable and moveable polymaterial Cultural Heritage in a changing environment"

**Abstract:** Government authorities, restoration architects and conservation scientists have always had to face the problem of deterioration of historic building materials, in particular stone, wood and glass; an issue that has become more and more urgent since climate change has worsened natural decay and the impact of atmospheric pollution. In addition in recent years socio-economic requirements have claimed for a more sustainable use of existing building heritage. On these premises, the NANOMATCH project will address this issue through the development of a class of innovative consolidants to be specifically designed to meet the requirements of the historic substrates and to identify high performance products to renovate the market dedicated to the conservation of the built heritage. Alkaline earth and semi-metal alkoxides precursors will be synthesized tuning their properties on the basis of the stone, wood and glass-substrate characteristics and the specific functionality to be addressed, leading to a new generation of nano-

structured materials tailored specifically for historic materials in a climate change context, merging from the most recent advanced research in the fields of nanotechnologies and conservation science. The development of suitable products for treatment of historic materials will finally halt the current use of inappropriate commercial products, especially polymers, that were designed for completely other purposes than the conservation of cultural heritage and that, in the recent years, show the detrimental effects due to their fast deterioration, that hampers the treated material too. Central in the project is the synthesis of molecular precursors, nano-coating deposition and related properties assessment finalized to the production of innovative products to update the market of conservation products as a real alternative for unfitting traditional ones. The basis for their production and introduction on the market will be developed during the project.

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**NBR: 283279** **ACRONYM: L-µPPT** **EC FUND: 1930432**

**DG:** REA **Call: FP7-SPACE-2011-1** **Thema:** SPA.2011.2.1-02

**Title:** Innovative Liquid Micro Pulsed Plasma Thruster system for nanosatellites

**Abstract:** The rapid emergence of new application domains and mission types has had a large impact on the evolution of spacecraft design. The current interest for micro-spacecrafts essentially proceeds from the wider availability of enabling technologies (micro/nano-fabrication), and from the desire to reduce development and launcher costs. Nanosatellites are also potentially useful as a mean to increase a mission's reliability by distributing a large payload over a fleet of small spacecrafts. However, the application range of micro-spacecraft is currently restricted by the lack of sufficiently compact, lightweight, high specific impulse micro-propulsion systems. The L-µPPT project will develop and assess the functionality of a novel PPT technology based on liquid propellant, expected to enable significant improvements over Teflon-based PPTs in terms of propellant utilization and impulse bit predictability through a tight control of the mass of propellant injected. By leveraging state-of-the-art MEMS technologies, the L-µPPT project will develop a compelling propulsion technology for microspacecrafts offering the scalability and robustness of conventional PPTs with performances in par with modern electric propulsion systems for large satellites. The L-µPPT project roadmap bases on a two-step implementation which comprehends the development of a first prototype, followed by the design of a fully functional prototype. Each prototype shall have an associated system specification phase, and subsequent design and development phases for each system subcomponents (thruster, injector, electronics, thrust balance and vacuum stand). Six partners (four SMEs, a industry and a research organization) from 4 Member States- Spain, Poland, Sweden and France, and Switzerland, with different roles in the project, will work together to advance in the development of PPT propulsion system.

**NBR: 283501** **ACRONYM: FAST TRACK** **EC FUND: 9300000**

**DG:** RTD **Call: FP7-NMP-ENERGY-2011** **Thema:** ENERGY.2011.2.1-2

**Title:** Accelerated development and prototyping of nano-technology-based high-efficiency thin-film silicon solar modules

**Abstract:** In recent years, the effort in thin-film silicon (TFSi) was made at solving industrialization issues. In 2010, several companies demonstrated 10% stable modules (>1 m²). The major "bricks" for efficient production are now in place. Next challenges are linked to the fact that TFSi multi-junction devices, allowing for higher efficiency, are complex devices, in which the substrate geometry and each layer have an impact on the full device. This explains why the first industrializations focused on "single technology" roads (e.g., Jülich-AMAT or EPFL-Oerlikon approaches). This project focuses at bringing the next-generation technology to the market, using newly developed state-of-the art knowledge to solve the complex puzzle of achieving at the same time strong light in-coupling (high current) and good electrical properties (open-circuit voltage and fill factor). In a unique collaborative effort of the leading EU industries and research institutions in the field, the consortium will go beyond the current technology status by • Introducing novel materials, including multi-phase nanomaterials (such as doped nc-SiOx, high crystallinity nc-Si materials), stable top cell materials, nanoimprinted substrates and novel or adapted transparent conductive oxides; • Designing and implementing ideal device structures, taking into account the full interaction of layers in multi-junction devices; • Controlling the growth of active layers on textured materials; • Working at processes that could allow a further extension of the technology such as very high rate nc-Si deposition or multi-step superstrate etching; • Transferring processes, including static and dynamic plasma deposition, from the laboratory to pilot scale, with first trials in production lines. The targets of the project is to achieve solar cells with 14% stable efficiency, leading to the demonstration of reliable production size prototypes module at 12% level. Potential cost below 0.5€/Wp should be demonstrated.

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**NBR: 283686** **ACRONYM: GLOBAL EXCURSION** **EC FUND: 800000**

**DG:** CNECT **Call: FP7-INFRASTRUCTURES-2011-2** **Thema:** INFRA-2011-3.4.

**Title:** GLOBAL excursion - Extended Curriculum for Science Infrastructure Online

**Abstract:** GLOBAL excursion will introduce e infrastructures to educators and pupils. It provides scientists, policy makers, pupils and their teachers a package of activities, materials and tools for enabling the integration of e infrastructures into school curricula. Main access

point is the GLOBAL Virtual Science Hub – "ViSH". It contains a selection of e Infrastructures, and a social network where scientists, teachers and pupils will be able to exchange and establish collaborations, and a virtual excursion room, where pupils will be able to experience real e-science applications in areas of high relevance for the future, such as nano- and biotechnologies. The technological basis of the Virtual Science Hub is the VCC, a communication platform developed in the GLOBAL project, which has already proven to successfully link distant researchers and to integrate remote regions. To allow for closer links between stakeholder communities, the hub will include a pedagogical framework that tailors science content to the needs of schools preconditions. With this aim, teachers and scientists will be involved in a user-centred design process and collaboratively elaborate generic tools and methods, offering joyful formats attractive to young people. With the ViSH portal as a hub, virtual excursions are possible through existing e-infrastructures and together with pedagogical concepts, a more efficient use of e infrastructures will be ensured. Teachers will have access to guided and compact materials, easy to implement and adapt in their teaching activities. Together with end-users, GLOBAL excursion will develop a common understanding, teaching use cases, as well as pedagogical and technical artefacts. The aim of this project proposal is to provide young citizens and their educators (teachers, parents, etc.) across Europe with a range of e-Infrastructures and access to expert knowledge on its usage for a joyful exploration of e-Science through e-Infrastructure. Based on the experience from previous projects, we intend to target pupils between 14-18 years of age (upper stage school). Participating schools and science communicators will elaborate communication and teaching activities. The driving themes will be nano- and biotechnologies, as well as volunteer computing and life sciences with an interdisciplinary focus especially including ethical, legal and social aspects (ELSA). The main purpose of the GLOBAL excursion project is to enable students and teachers access to the experimental laboratories and resources of selected e-Infrastructures in order to improve science curricula by enriching school's existing teaching and learning materials. By connecting e Infrastructures, resources and tools with schools, pupils can experience challenging and authentic learning scenarios. Thus, students gain insights in scientific real work and relive interest in natural science education.

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**NBR: 283798** **ACRONYM: NGCPV** **EC FUND: 4999998**

**DG:** RTD **Call: FP7-ENERGY-2011-JAPAN** **Thema:** ENERGY.2011.2.1-1

**Title:** A new generation of concentrator photovoltaic cells, modules and systems

**Abstract:** The Project, through a collaborative research between seven European and nine Japanese leading research centers in the field of concentration photovoltaics (CPV), pursues the improvement of present concentrator cell, module and system efficiency. Particular effort will be devoted to the development of multijunction solar cells (by researching on metamorphic, lattice match, inverted and bifacial growth, use of silicon

substrates and incorporation of quantum nanostructures) with the objective of approaching the 50 % efficiency goal at cell level and 35% at module level (by incorporating advanced optics as for example Fresnel-Kohler concentrators). As a means to speed up the progress, the Project will also expand the use of characterization techniques suitable for CPV materials, cells, trackers, modules and systems by developing new ones, incorporating advanced semiconductor techniques to the field of photovoltaics (such as three dimensional real-time reciprocal space mapping, 3D-RTSM, piezoelectric photo-thermal and optical time resolved techniques) and by deploying a round robin scheme that allows the qualification and standardization of the results derived from the measurements. To support all these studies from a global perspective and, in particular, to ensure an accurate forecast of the energy produced at system level, the Project plans to build a 50 kW concentrator plant. To achieve its goals, the Project is structured into five RTD workpackages: new materials and device characterization, development of novel device technologies and quantum nanostructures for CPV, development of advanced CPV cells, development of characterization tools for CPV cells, modules and systems and development of CPV modules and systems. To strength the collaboration between EU and Japan, the Proposal also foresees more than 20 interchange visits. NGCPV is an EU coordinated project in the framework of call FP7-ENERGY-2011-JAPAN, forseeing a simultaneous start with the Japanese coordinated project. Accordingly, the Japanese project should start at the latest within 3 months of the signature of the EU grant agreement.

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**NBR: 283974** **ACRONYM: R2R-CIGS** **EC FUND: 7021501**

**DG:** RTD **Call: FP7-NMP-ENERGY-2011** **Thema:** ENERGY.2011.2.1-2

**Title:** Roll-to-roll manufacturing of high efficiency and low cost flexible CIGS solar modules

**Abstract:** CIGS solar module technology on rigid glass substrate is already mature and industrial companies are producing hundreds of MWp each year. Bringing flexible CIGS solar modules to industrial maturity will yield the next breakthrough for further cost reduction by taking into account the inherent advantages of thin film technology, e.g. high throughput and large scale coating with less energy and material consumption. The aim of R2R-CIGS is to develop efficient flexible solar modules by implementing innovative cost-effective processes such that production costs below 0.5 €/Wp can be achieved in large volume factories with annual capacity of 500MWp in future. The main objectives of this project are: • Flexible solar cells on polymer film with 20% efficiency and mini-module with 16% efficiency by control of composition gradient, surface, and interface properties on nano-scale • Transfer of innovative buffer layer process for roll-to-roll manufacturing and replacing problematic CBD-CdS by higher yield processes such as (spatial) ALD and ultrasonic spray • Developing fully laser based patterning technology for monolithic interconnection in R2R pilot-line • Scale-up of static multi-stage CIGS deposition process from laboratory scale towards inline R2R compatible

processes • Implementation of the up-scaled multi-stage CIGS deposition process into pilot lines for R2R manufacturing of flexible CIGS modules • Development of moisture barrier with WVTR< 5x10-4 g/m2/d and cost-effective encapsulation • Decrease cost of ownership for enabling production costs below 0.5 €/Wp for a commercial plant with annual production of 500 MWp in future

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**NBR: 284427** **ACRONYM: QB50** **EC FUND: 7998703**

**DG:** REA **Call: FP7-SPACE-2011-1** **Thema:** SPA.2011.3.2-02

**Title:** An international network of 50 CubeSats for multi-point, in-situ measurements in the lower thermosphere and re-entry research

**Abstract:** The QB50 Project will demonstrate the possibility of launching a network of 50 CubeSats built by CubeSat teams all over the world as a primary payload on a low-cost launch vehicle to perform first-class science and in-orbit demonstration in the largely unexplored lower thermosphere. Space agencies are not pursuing a multi-spacecraft network for in-situ measurements in the lower thermosphere because the cost of a network of 50 satellites built to industrial standards would be very high and not justifiable in view of the limited orbital lifetime. No atmospheric network mission for in-situ measurements has been carried out in the past or is planned for the future. A network of satellites for in-situ measurements in the lower thermosphere can only be realised by using very low-cost satellites, and CubeSats are the only realistic option. The Project will demonstrate the sustained availability of a low-cost launch vehicle, a Russian Shtil-2.1, for launching small payloads into low-Earth orbit; these could be microsatellites or networks of CubeSats or nanosats or many individual small satellites for scientific, technological, microgravity or biology research. The Project will include the development of a deployment system for the deployment into orbit of a large number of single, double or triple CubeSats. Once the system is developed for QB50 it can be easily adapted to other missions. QB50 will also provide a launch opportunity for key technology demonstration on IOD CubeSats and for the Gossamer-1 solar sail technology demonstration package for rapid de-orbiting. All 50 CubeSats will be launched together at month 36 into a circular orbit at 320 km altitude. Due to atmospheric drag, the orbits of the CubeSats will decay and progressively lower and lower layers of the thermosphere will be explored without the need for on-board propulsion, perhaps down to 90 km. QB50 will be the first CubeSat network in orbit.

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**NBR: 284433** **ACRONYM: SINPLEX** **EC FUND: 1998619**

**DG:** REA **Call: FP7-SPACE-2011-1** **Thema:** SPA.2011.2.1-02

**Title:** Small Integrated Navigator for PLanetary EXploration

**Abstract:** The main goal of the SINPLEX project is to develop an innovative solution in order to reduce significantly the mass of the navigation subsystem for exploration missions which include a landing and/or a rendezvous and capture or docking phase. It is a contribution to the strengthening of the European position for space exploration. It targets increasing the scientific return of exploration missions, enabling new types of missions and targets, and reducing launch cost and travel time. Several planned international space exploration missions target the Moon, asteroids, comets, planets and planetary moons. They will bring robotic vehicles to these targets and will provide the capability to return samples to Earth. In general for all space mission but in particula for this kind of missions, mass is one of the most critical factors. Therefore reducing the mass of components or complete subsystems of an exploration vehicle is a key enabling factor for the future exploration of our solar system and beyond. The mass reduction - while still creating a good navigation performance - is achieved by (1) applying functional integration of the different sensors, (2) utilizing micro and nanotechnologies for compacting electronics, and (3) using sensor hybridization approaches to improve the performance of the complete navigation subsystem. The project's objectives are: (a) the development of a integrated novel navigation subsystem architecture, (b) the production of a breadboard and (c) the demonstration of its applicability for object relative robotic navigation for space applications (TRL 4). The first phase of the project will focus on elaborating the requirements and defining an architecture of the navigation system. This will be followed by design phase, a manufacturing phase and a verification phase where the produced beadboard hardware and software will be tested in terrestrial test benches and test facilities.

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**NBR: 284486** **ACRONYM: SCALENANO** **EC FUND: 7541468**

**DG:** RTD **Call: FP7-NMP-ENERGY-2011** **Thema:** ENERGY.2011.2.1-2

**Title:** Development and scale-up of nanostructured based materials and processes for low cost high efficiency chalcogenide based photovoltaics

**Abstract:** This project will exploit the potential of chalcogenide based thin film photovoltaic technologies for the development and scale-up of new processes based on nanostructured materials for the production of high efficiency and low cost photovoltaic devices and modules compatible with mass production requirements. Cu(In,Ga)(S,Se)2 (CIGS) chalcogenide based devices have the highest efficiency of all thin film PV technologies, having recently achieved a record value of 20.3% at cell level. These technologies have already entered the stage of mass production, with commercial modules that provide stable efficiencies in the 11-12% range, and a predicted world-side production capacity over 2 GW/a for 2011. However, current production methods in CIGS industrial technologies typically rely on costly, difficult to control (over large

surfaces) vacuum-based deposition processes that are known for low material utilisation of 30-50%. This compromises the potential reduction of material costs inherent to thin film technologies. At the forefront of this, the SCALENANO project proposes the development of alternative environmental friendly and vacuum free processes based on the electrodepositon of nanostructured precursors with the objective to achieve a much more efficient exploitation of the cost saving and efficiency potential of CIGS based PV. The project also includes the exploration and development of alternative new processes with very high potential throughput and process rate based in the use of printing techniques with novel nanoparticle ink formulations and new cost effective deposition techniques, that will allow proposing an industrial roadmap for the future generation of chalcogenide based cells and modules

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**NBR: 284500** **ACRONYM: EUCARBON** **EC FUND: 1997446**

**DG:** REA **Call: FP7-SPACE-2011-1** **Thema:** SPA.2011.2.2-02

**Title:** European Space Qualified Carbon Fibres and Pre-Impregnated Based Materials

**Abstract:** EUCARBON project aims to overcome the present recognised need of European made space qualified carbon fibre and pre-impregnated materials (prepregs). These materials are the building blocks for technological innovation in Space research. Presently aerospace qualified carbon fibre is either produced outside Europe or produced in Europe under foreign countries supervision. This issue weakens European competitiveness in Space. Therefore, the possibility for Europe to have free, unrestricted access to these materials requires their development in European facilities under European supervision. The following developments will result from the project: -High and ultrahigh modulus carbon fibres to be produced in Europe by a European manufacturer -Space qualified pre-impregnated materials involving the developed carbon fibres and epoxy resins doped with carbon nanotubes. These novel materials will address one of the main issues linked to use of carbon fibres composites in space applications: their low thermal and electrical conductivity. The above technologies will be demonstrated with the conception, production and testing of demonstrator parts for use as satellites and launchers components. The space sector is a strategic asset contributing to the independence, security and prosperity of Europe and its role in the world. Europe needs non-dependent access to critical space technologies, which is a sine-qua-non condition for achieving Europe's strategic objectives. Non-dependence refers to the possibility for Europe to have free, unrestricted access to any required space technology. EUCARBON project intends to give a contribution in the space qualified carbon fibres and novel pre-impregnated materials issue. Moreover, this development will provide raw-materials to other strategic sectors of industry in Europe like: aircraft, automotive, and others.

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**NBR: 284544** **ACRONYM: PARM-2** **EC FUND: 1775354**

**DG:** REA **Call: FP7-PEOPLE-2011-IAPP** **Thema:** FP7-PEOPLE-2011-IAPP

**Title:** VIBRO-IMPACT MACHINES BASED ON PARAMETRIC RESONANCE: Concepts mathematical modelling experimental verification and implementation"

**Abstract:** The aim of the project is to enhance the potential and output of vibrating machines and decrease their ecological footprint by implementation of parametric resonance (PR). Compared with the regular resonance, the PR is characterized by a much higher intensity within a wide range of frequencies. The advantage of a PR-based machine was demonstrated with a prototype PR screener (PRS) developed and produced by the project partners. The PRS demonstrated large amplitudes of high-frequency lateral oscillations and self-vibro-insulation and could process a naturally wet fine granular material. However, the PR is instable, and its use as an effective operating mode assumes, among others, creation of a 'stabilized instability' regime. This is an inspiring and challenging high-tech task for combined efforts of applied mathematicians and engineers. The extraordinary PR features together with open nontrivial theoretical and engineering problems provide a motivation to undertake this interdisciplinary research. The main objectives are: to develop a technically sound control of PR amplitude; to develop mathematical models for the process of material separation with a PRS; to design PRS-related screens with given stiffness and minimal bending stresses, and to design other types of PR-based separators and crushers. The enhancement of vibro-cutting/drilling tools via the development of the underpinning theory and application of the PR principle will also be an objective. An exchange of fundamentals and technical concepts between the large-scale research and the micro/nano PR studies is assumed. The project activities will be based on close cooperation and targeted secondments between academia and industry. As a result, a large number of ESRs will have a unique opportunity to be trained through research, working on all interdisciplinary aspects, starting from the conceptual design and modelling and finishing with prototypes/demonstrators of new PR-based machines and tools.

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**NBR: 284558** **ACRONYM: GRAPHENE-CA** **EC FUND: 1355000**

**DG:** CNECT **Call: FP7-ICT-2011-FET-F** **Thema:** ICT-2011.9.5

**Title:** Coordination Action for Graphene-Driven Revolutions in ICT and Beyond

**Abstract:** This Coordination Action aims to prepare a European Flagship project focussed on "Graphene-Driven Revolutions in ICT and Beyond" (GRAPHENE). The overwhelming current focus on graphene, discovered by A.K. Geim and K. Novoselov in 2004, is driven by the considerable and tantalizing potential that this material offers in conventional as

well as radically new fields of ICT applications. Europe can play a key role in future graphene-based ICTs provided a long term strategy of transferring knowledge and intellectual property to technological applications is carried out in a coordinated, effective and organized fashion. GRAPHENE-CA will establish a comprehensive scientific and technological roadmap, by taking advantage of the activities of an existing nanoICT graphene working group, contributions of selected industrial partners and key scientists such as the Nobel Laureates A.K. Geim, K. Novoselov, A. Fert and K. von Klitzing. This roadmap will be the basis to develop the research agenda for the subsequent GRAPHENE flagship, which will cover electronics, spintronics, photonics, plasmonics and mechanics based on graphene, and supporting areas such as graphene production and graphene chemistry. The CA will frame the development of a graphene flagship that is aimed to serve as a sustainable incubator of new branches of ICTs applications, rooted on European scientific excellence and interdisciplinarity (merging physics and chemistry with engineering communities), and providing Europe a strategic instrument and infrastructure for innovation in ICT-related science and applications.

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**NBR: 284562** **ACRONYM: SARISTU** **EC FUND: 32434311**

**DG:** RTD **Call: FP7-AAT-2011-RTD-1** **Thema:** AAT.2011.4.4-3.

**Title:** Smart Intelligent Aircraft Structures

**Abstract:** The project proposal concerns the challenges posed by the physical integration of smart intelligent structural concepts. It addresses aircraft weight and operational cost reductions as well as an improvement in the flight profile specific aerodynamic performance. This concerns material concepts enabling a conformal, controlled distortion of aerodynamically important surfaces, material concepts enabling an active or passive status assessment of specific airframe areas with respect to shape and potential damages and material concepts enabling further functionalities which to date have been unrealizable. Past research has shown the economic feasibility and system maturity of aerodynamic morphing. However, few projects concerned themselves with the challenges arising from the structural integration on commercial aircraft. In particular the skin material and its bonding to the substructure is challenging. It is the aim of this project proposal to demonstrate the structural realizability of individual morphing concepts concerning the leading edge, the trailing edge and the winglet on a full-size external wing by aerodynamic and structural testing. Operational requirements on morphing surfaces necessitate the implementation of an independent, integrated shape sensing system to ensure not only an optimal control of the aerodynamic surface but also failure tolerance and robustness. Developments made for structural health monitoring will be adapted to this task. Similar systems optimized for rapid in-service damage assessment have progressed to a maturity which allows their inclusion in the next generation of aircraft. However, the time consuming application of these sensor systems has to be further improved by integration at the component manufacturing

level. The additional benefit of a utilization of these adapted systems for part manufacture process and quality control shall be assessed in SARISTU. Addressing the Nanotechnology aspect of the call, benefits regarding significant damage tolerance and electrical conductivity improvements shall be realized at sub-assembly level.

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**NBR: 284743** **ACRONYM: SPANGL4Q** **EC FUND: 1965153**

**DG:** CNECT **Call: FP7-ICT-2011-C** **Thema:** ICT-2011.9.1

**Title:** Spin-Photon Angular Momentum Transfer for Quantum-Enabled Technologies

**Abstract:** The goal of this project is the development of a suite of nanophotonic devices that interface with spins, for application in quantum information and quantum-enabled classical communi-cation technologies. Our technologies will be based on electron and nuclear spins in semi-conductor quantum dots (QDs) embedded in nanophotonic devices. We will combine knowledge of the physics of semiconductor spins, photonics and cavity quantum electro-dynamics, with quantum information and optical communication technology. In this FET-Open project, we anticipate that a wealth of novel devices and fundamental un-derstanding will result from the solution to one key problem. What is the best form for a hybrid spin-photon quantum memory, how does one transfer quanta of angular momentum from it to a single photon, and how will this angular momentum be encoded? This is an issue that is inadequately addressed so far, and we take highly novel approaches towards it. We address this question on several fronts. From the photonics side, polarization engineering in photonic nanostructures will be investigated, moving beyond linear polarization to exploit the full light angular momentum states. In terms of quantum memories, we will create the technology for long-lived (>1s) nuclear spin memories, long enough to achieve entanglement over large distances. These might one day be used over 1000's km and via satellites to po-tentially anywhere on the globe. Photonic crystal structures will be used for integrated quantum-optical circuit technology and plasmonic nanoantennas will enable a spin-dependent near-to-far field coupling, and ultra-fast control of the electron spin. One may use this spin-photon interface to entangle very large numbers of photons, with the memory allowing time for measurement operations of a quantum algorithm. The compatibility of these QD technologies means that the components may be combined, paving the way towards an entirely QD-based "quantum internet".

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**NBR: 284838** **ACRONYM: NANOFRABS** **EC FUND: 1063700**

**DG:** REA **Call: FP7-SME-2011** **Thema:** SME-2011-1

**Title:** Halogen Free Flame Retardant ABS nanocomposites for electric and electronic devices

**Abstract:** The Restriction of Hazardous Substances (RoHS) and waste electric and electronic equipment (WEEE) directives discouraged the use of halogenated flame retardants in electric and electronic devices. For this reason, effective non halogenated alternatives have to be developed. The project aims at developing new halogen free flame retardant (HFFR) for ABS (acrylonitrile-butadiene-styrene) compounds, which are widely use in the electric appliances sector, with good impact and fire properties. In order to reach these improvements, nanofillers will be combined with phosphorous-based flame retardants, either a) by Physical Combination of flame retardants and nanofillers in proper mixtures (PC), b) by Chemical Combination of nanofillers with flame retardants (CC) or c) by Physical Combination of Chemical functionalized lamellas and flame retardants (PCC) to be dispersed in the polymer by melt blending or melt reactive blending. NANOFRABS counts on a well balanced consortium of 4 SMEs and 2 RTDs. SMEs partners are complementary and cover the whole project necessities: nanoparticles, fire retardant, ABS compounder and an end-user. The RTD performers cover the four necessary scientific fields: Nanotechnology, polymer science, fire behaviour and flame retardants.

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**NBR: 285037** **ACRONYM: INTASENSE** **EC FUND: 2465354**

**DG:** RTD **Call: FP7-2011-NMP-ENV-ENERGY-ICT-EeBThema:** EeB.ENV.2011.3.1.5-1

**Title:** Integrated air quality sensor for energy efficient environment control

**Abstract:** Space heating accounts for more than 50% of the energy consumption of public & residential buildings, and reduction of this energy demand is a key strategy in the move to low energy/low carbon buildings. The careful management of air flow within a building forms part of this strategy through the control of inlet fresh air and exhaust air, maximising air re-circulation, and minimising the amount of fresh air which is often drawn in through a heat exchanger. However, there is a high risk that the air quality is reduced. Continued exposure to environments with poor air quality is a major public health concern in developed and developing countries. It is estimated that the pollutants responsible for poor air quality cause nearly 2.5 million premature deaths per year world-wide. Significantly, around 1.5 million of these deaths are due to polluted indoor air, and it is suggested that poor indoor air quality may pose a significant health risk to more than half of the world's population. Perhaps surprisingly, remedial action to improve air quality is often easy to implement. Relatively simple measures such as increased air flow through ventilation systems, or a greater proportion of fresh air to re-circulating air are sufficient to improve air quality. Low-energy air purification and detoxification technologies are available which will reduce the concentration of specific pollutants. Similarly, filtration systems (e.g. electrostatic filters) can be switched in to reduce the level of the particulate matter in the air (the principle pollutant responsible for poor health). The INTASENSE concept is to integrate a number of micro- and nano-

sensing technologies onto a common detection platform with shared air-handling and pre-conditioning infrastructure to produce a low-cost miniaturised system that can comprehensively measure air quality, and identify the nature and form of pollutants. INTASENSE is a 3-year project which brings together 8 organisations from 5 countries.

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**NBR: 285275** **ACRONYM: GRAFOL** **EC FUND: 6900000**

**DG:** RTD **Call: FP7-2011-NMP-ICT-FoF** **Thema:** FoF.NMP.2011-6

**Title:** GRAPHENE CHEMICAL VAPOUR DEPOSITION: ROLL TO ROLL TECHNOLOGY

**Abstract:** Graphene has some unique properties resulting from its linear dispersion band structure, its high carrier mobility, and its low dimensionality. However, its use is presently limited by its synthesis and mass production. The project aims to develop the first roll-based chemical vapour deposition (CVD) machine for the mass production of few-layer graphene for transparent electrodes for LED and display applications, and adapts the process conditions of a wafer-scale carbon nanotube growth system to provide a low-cost batch process for graphene growth on silicon. The project focuses on applications such as transparent electrodes for OLEDs and GaN LEDs, optical switches, plasmonic waveguides, VLSI interconnects, sensors and RF NEMs.

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**NBR: 285718** **ACRONYM: NANOMASTER** **EC FUND: 4199974**

**DG:** RTD **Call: FP7-2011-NMP-ICT-FoF** **Thema:** FoF.NMP.2011-6

**Title:** Graphene based thermoplastic masterbatches for conventional and additive manufacturing processes

**Abstract:** The aims of the NanoMaster project are to reduce the amount of plastic used to make a component by 50% and hence reduce component weight by 50%, at the same time as imparting electrical and thermal functionality. This will be achieved by developing the next generation of graphene-reinforced nano-intermediate that can be used in existing high-throughput plastic component production processes. Graphene reinforced polymers have been demonstrated at lab scale in both Europe and the USA, and it has been shown that very low loadings of graphene can have a dramatic impact on the mechanical and physical properties of the polymers it is added to. However, industrial compounding processes have only so far been developed in the United States, where Ovation Polymers are already offering graphene thermoplastic masterbatches and compounds based on graphene from XG Sciences. The concept for this project is to develop the knowledge-based processing methods required to up-scale the production of graphene and expanded graphite reinforced thermoplastic masterbatches and

compounds and, ultimately, enable its industrial commercialisation in Europe. The work will focus on developing processes for large scale rapid production of graphene reinforced plastic intermediate materials which can be integrated into current conventional and additive manufacturing processes. Successful development of these materials and processes will have a significant effect on the amount of polymer that needs to be used in a component to meet its performance criteria, and on the ability of plastic mouldings to delivery significantly enhanced functionality. These breakthroughs will open the door to a vast range of applications enabling the benefits to be exploited throughout Europe and beyond. They will also help to place European companies in a position to exploit the rapidly growing markets in the US and Asia-Pacific.

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**NBR: 285895** **ACRONYM: AL-NANOFUNC** **EC FUND: 2687409**

**DG:** RTD **Call: FP7-REGPOT-2011-1** **Thema:** REGPOT-2011-1

**Title:** ADVANCED LABORATORY FOR THE NANO-ANALYSIS OF NOVEL FUNCTIONAL MATERIALS

**Abstract:** The AL-NANOFUNC project has been designed to install and fully develop at the Materials Science Institute of Seville (ICMS, CSIC-Univ.Seville, Spain) an advanced laboratory for the Nano-analysis of novel functional materials. Advanced Nanoscopy facilities, based on latest generation electron microscopy equipments, will be devoted to breakthrough research in specific topics of high interest: i) Nanomaterials for sustainable energy applications; ii) protective and multifunctional thin film and nanostructured coatings; iii) nanostructured photonic materials and sensors. To take the ICMS laboratories to a leading position that is competitive in a world-wide scenario, the AL-NANOFUNC project is contemplated to up-grade the actual research potential in several directions: i) improve equipment capabilities regarding the Analytical High Resolution Electron Microscopy facilities; ii) improve the impact and excellence of basic research through hiring of experienced researchers and transnational exchange with the reference centers in Europe; iii) develop and improve the innovation potential of the ICMS's research by opening the new facilities to companies and stakeholders; iv) organize workshops and conferences, dissemination and take-up activities to improve research visibility. Close collaborations with reference centers and companies in Liège (Belgium), Graz (Austria), Jülich (Germany), Oxford (England), Cambridge (England), Dübendorf (Switzerland) and Rabat (Morocco), as well as with laboratories at Andalucian Universities, are foreseen in this project. Five companies in Andalusia will also collaborate in close synergies to promote the long-term strategic lines of interest for the region in the natural and artificial stone products and solar and renowable energy sectors.

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**NBR: 285949** **ACRONYM: NOBLESSE** **EC FUND: 3321290**

**DG:** RTD **Call: FP7-REGPOT-2011-1** **Thema:** REGPOT-2011-1

**Title:** NanOtechnology, Biomaterials and aLternative Energy Source for ERA integration

**Abstract:** The overarching goal of the NOBLESSE project is to establish the Institute of Physical Chemistry, Polish Academy of Sciences (IPC-PAS) as an integrated partner and respected participant in the European nanoscience community. The IPC-PAS has a strong research record in both fundamental studies of physiochemical processes as well as application oriented research. The use and control of nanostructured materials is of great importance for the development of new environmentally friendly materials, more efficient energy-sources and biosensors for medical analysis. The NOBLESSE project will bring essential equipment to the institute, but also help create a Polish nanoscience network to survey the major equipment at Polish research centres and make sure that necessary equipment is available to the researchers. This will be an important development not only for IPC-PAS but for Polish nanoscience as a whole. A major part of the NOBLESSE project is reinforcing the research potential of the Institute by bringing in new experienced researchers and strengthening the staff through a number of supporting activities such as training programs, networking, improvements in dissemination and collaboration with industry. The most important part of fully integrating the IPC-PAS into the ERA community is the establishment of strong partnerships with mutual staff secondments with a network of leading EU research centres sharing scientific interests. This will lead to a large contact area, promoting the Institute and further integrating its staff into EU projects and international collaboration. The planned activities within NOBLESSE will firmly position IPC-PAS as a leading research centre on a national level, contribute to preventing brain drain by offering young devoted researchers competitive resources and facilitate the exchange of know-how with the wider scientific community but equally important with the public and potential business partners. The creation of stronger bonds between academia and industry is of vital importance for IPC-PAS and for society as a whole.

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**NBR: 285974** **ACRONYM: TERA** **EC FUND: 1104208**

**DG:** REA **Call: FP7-PEOPLE-2011-IAPP** **Thema:** FP7-PEOPLE-2011-IAPP

**Title:** Novel Compact Terahertz source based on Dual Wavelength Lasers and Photomixers

**Abstract:** TERA proposes to perform a joint industry academia research programme capitalising on the knowledge and expertise of the partners through exchanges of researchers and transfers knowledge between research centres in Photonics and Nanoscience at the University of Dundee and SME UAB TERAVIL with expertise in different aspects of laser physics, material science and THz radiation. The aims are to overcome scientific and technical barrier to the realisation and adoption of low-cost technologies for the

fabrication of compact room-temperature terahertz sources emitting few tens of μW powers at 0.3–1.5 THz and beyond for Biophotonics and Safety and Security applications. The THz radiation will be obtained by difference frequency generation from CW or pulsed dual wavelength laser produced by combination of laser diodes with novel volume Bragg reflectors . Together the project partners will evaluate several variants for the THz generation procedures. Photoconductive mixers based on traditional and new materials and photovoltaic travelling-wave mixers will be assessed, targeting increased conversion efficiency

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**NBR: 286059** **ACRONYM: CORESHELL** **EC FUND: 856022**

**DG:** REA **Call: FP7-PEOPLE-2011-IAPP** **Thema:** FP7-PEOPLE-2011-IAPP

**Title:** Marine nanobiotechnology: Manganese oxide-containing core-shell materials formed by proteins from marine organisms for biomedical and environmental applications

**Abstract:** Core-shell materials are of enormous interest for many applications in nanotechnology and nanomedicine. Only recently, due to the achievements of the consortium, the generation of such nanoparticles by applying unique proteins from marine organisms has become possible. In this IAPP, based on a long-term and very successful cooperation between groups in Germany and Croatia, well known in the field of marine biotechnology of sponges and associated microorganisms, and now extended by an SME (NanotecMARIN GmbH) with a special focus on the exploitation of marine metal-oxide forming enzymes / proteins, a marine bacterial multicopper oxidase (MCO) and a sponge laccase, which are able to catalyze the oxidation of Mn(II) to Mn(IV), will be used to generate novel metal oxide nanocomposite materials. Enzymatically active MCO will be immobilized on magnetic iron oxide nanoparticles to enzymatically fabricate core-shell materials. In addition, MCO and laccase will be applied in combination with silica or other metal oxide-forming proteins (recombinant silicatein and silintaphin-1) to generate nanoparticles containing multiple shells of various materials, which can be doped with fluorescent dyes and proteins during their formation at mild conditions. These core-shell nanoparticles will be used in drug delivery, for removal of manganese or other heavy metals from contaminated aqueous solutions (remediation of contaminated environments), as well as for the development of antifouling strategies.

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**NBR: 286060** **ACRONYM: SUNGREEN** **EC FUND: 3879420**

**DG:** RTD **Call: FP7-REGPOT-2011-1** **Thema:** REGPOT-2011-1

**Title:** Strengthening University of Nova Gorica Research Potential in Environmental Sciences and Novel Nanomaterials

**Abstract:** The SUNGREEN project seeks to reinforce the University of Nova Gorica, strengthening its innovative approach for research and development of new knowledge in environmental science and novel nano-structured materials. The reinforcement will be realized through establishment of strategic partnerships with top European R&D centres, recruitment of experienced researchers, acquisition of state-of-the-art research infrastructure, enhancement of UNG visibility and its collaboration with different stakeholders in the region. Through the implementation of the project, UNG will reach its full potential for research and technological innovation and will become one of the leading European research centres in the field environmental sciences and nano-materials. Excellent environmental science reputation of UNG is the result of integration of physics, chemistry, biology material science and computational science disciplines. Main objective of the project is strengthening of the research potential of UNG that needs new knowledge and research equipment. Project will enhance the capacity of UNG to successfully participate in research activities at EU level. The objective will be achieved through networking with other European world class research players, upgrading of relevant RTD infrastructure, recruitment of experienced researchers as well as through dynamic contribution to the regional and European sustainable socio-economic development through networking and dissemination activities. Project will pave paths for industrial uptake of new environmental technologies and will contribute to knowledge based economy and last but not least to cleaner environment. Transfer of know how will enable industries in the region at European level to produce innovative new products with high added value. Through project implementation, UNG will establish partnerships that will enable economically sustainable research both alone and in collaboration with network of partnering organizations.

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**NBR: 286061** **ACRONYM: NEFELE** **EC FUND: 830011**

**DG:** REA **Call: FP7-SME-2011** **Thema:** SME-2011-1

**Title:** Nano- Electrospun Filter for Efficient Liberation & Encapsulation of acticides for water treatment in transportation applications

**Abstract:** In recent years, word of aircraft water quality issues has spread, generating negative media coverage, attracting the attention of regulators worldwide, and giving airline passengers a new cause for concern. Health enforcement agencies are currently in the process of drafting new, more stringent quality regulations for aircraft potable water and the world's other regulators will follow suit. Aircraft potable water is typically loaded from municipal systems which are susceptible to contamination. While municipal water quality has always been a concern in some parts of the world, it is now becoming an issue in North America as well. As recent outbreaks of waterborne disease in carries

Canada and the US illustrate, dependence on any municipal water supply carries an inherent risk. Even when the source water is clean, contamination can make its way into a water supply during ground handling because of contaminated water trucks, contaminated hoses, or from improper handling procedures by ramp crew. The aircraft water system itself can be the source of contamination. Microorganisms can grow within the water tanks, water lines, and even the water filters. This situation is exacerbated by the standard, air pressurized water systems that allow water to remain still in the tank and distribution lines until a faucet is opened and the water begins to move. Bacteria thrive in such conditions, which also encourage bacterial regrowth almost immediately after system cleaning. The present project aims to provide an advanced treatment system which will make use of core/sheath polymer nanofibres which are filled with biocidal substances. This will provide a way of maintaining a constant level of biocide in the water without the need to dose or measure the quantities present. In addition the nanofibres will provide a means of physical entrapment for viruses.

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**NBR: 286089** **ACRONYM: ONCONANOBBB** **EC FUND: 849958**

**DG:** REA **Call: FP7-PEOPLE-2011-IAPP** **Thema:** FP7-PEOPLE-2011-IAPP

**Title:** Development and evaluation of a quantitative imaging technique for assessment of nanoparticle drug delivery across the blood-brain barrier: Applications for brain cancer therapeutics

**Abstract:** The partners wish to build a long term European, Industry-Academia consortium, to work on the problem of delivering therapeutic agents, e.g. for brain cancer, across the blood-brain barrier (BBB) at the efficacious dose. Current treatment options for brain cancer are limited with patients having a poor prognosis. One of the major hurdles is the BBB which prevents effective doses of drugs reaching the site of disease. There is thus a major need for technologies that can successfully overcome such a hurdle without having a negative effect on safety and tolerability. Pharmidex have developed a drug delivery system that transiently and reversibly opens the BBB to entry of compounds into the brain without inducing tissue injury. It is based on patented lipid-like structures and has been shown to deliver both small molecules and large proteins effectively into the brain. The lead delivery compound for brain cancer appears to be safe and well tolerated on the basis of pre-clinical testing. We initially seek to determine the mechanism of action of the technology for penetrating the BBB; application to different therapeutic agents as well as development of reliable brain cancer animal models to quantify efficacy of nanoparticle-based therapy using imaging technology. We believe this novel delivery technology will be a unique drug discovery tool with the potential to enhance efficacy of established agents, reduce systemic exposure of the chemotherapeutic agent, thus minimising both the on/off-target toxicity through enhancement of drug absorption at the target site. Besides its scientific objectives, OncoNanoBBB will provide a framework for cooperation and knowledge sharing

between a pharmaceutical industry and two academic institutions with complementary expertise in project objectives, as well as dissemination of project outcomes.

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**NBR: 286110** **ACRONYM: INTERCER2** **EC FUND: 2398292**

**DG:** REA **Call: FP7-PEOPLE-2011-IAPP** **Thema:** FP7-PEOPLE-2011-IAPP

**Title:** Modelling and optimal design of ceramic structures with defects and imperfect interfaces

**Abstract:** Ceramic industry is broadly developed in Europe and the current investment is estimated at € 26 billion. With its € 9,2 billion segment, Italy is a leader country in the production of traditional ceramics, while France, UK and Germany are driving countries for advanced ceramics, growing at 21% per year. Advanced ceramics are crucial for new technologies and nano-tech applications addressed to thermo-mechanical and bio-medical applications, while traditional ceramics have a worldwide market and have been suggested as materials minimizing the impact on the environment (when compared to other finishing materials). It may seem surprising that the strong industrial production of ceramic components is still based on empirically engineered processes, often poorly understood and difficult to control (Ewsuk, 1997). Consequently, there is a relatively large production of rejects and still broad margins for further process optimization. To this purpose, in-depth scientific understanding of the production processing is required, in order to reduce costs of ceramic component design and manufacturing and to produce ceramic components more reproducibly with improved performance and reliability. In particular, forming by powder compaction, binder burnout and sintering are the most sensible processes (Reed, 1995; Rahaman, 2006). The main aim of the research project is to develop novel advanced ceramic products in close collaboration between academic and industrial partners which will be directly oriented to industrial and social needs. The goal will be achieved by (i) improvement of the powder compaction and ceramic production process; (ii) development of novel advanced ceramic multifunctional materials and structures.

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**NBR: 286125** **ACRONYM: NANORESISTANCE** **EC FUND: 1410405**

**DG:** REA **Call: FP7-PEOPLE-2011-IAPP** **Thema:** FP7-PEOPLE-2011-IAPP

**Title:** Management of Resistance to Tyrosine Kinase Inhibitors with Advanced Nanosystems

**Abstract:** NANORESISTANCE introduces for the first time (i) receptor -independent targeting of Epidermal Growth Factor Receptor-kinase activity, (ii) nuclear delivery of anti-Epidermal Growth Factor Receptor therapy with novel grafting techniques and (iii) the deciphering

of resistance and lack of responsiveness to anti-EGFR therapies in the preclinical setting with mathematical models of interstitial biodistribution. This work defines an unprecedented integrated approach for the comprehensive management of failure to anti-EGFR therapy and treatment monitoring. This partnership will play a structuring role by allowing researchers to acquire key skills equally relevant to the public and private sectors including cutting edge nanobiotechnology techniques for fabrication of nanotheranostic conjugates for targeted nuclear drug delivery and imaging, pioneering approaches for intracellular targeting with carbon nanotubes (CNT), innovative mathematical models and assessment of biodistribution, state-of-the-art Surface Plasmon Resonance for assessing drug-target interactions, emerging technologies for in vivo protein-protein and theranostic compound-protein interaction with Bimolecular Fluorescence Complementation Assays (BIFCs).These parallel approaches provide a promising innovative solution in the multifaceted challenge of the overall resistance to anti-EGFR therapies. This will be achieved with the development of multimodal CNT-based nanoplatforms carrying the fluorescent conjugates of EGFR inhibitors intracellularly independenly of EGFR extracellular recognition. This system will further deliver anti-EGFR and fluorescent attributes to the nucleus. The partnership offers and a well-structured scheme of complementary skills highly inspired by the entrepreneurial spirit of academicians and research commitment of the industrial partners securing significant impact on their employability in their sector.

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**NBR: 286146** **ACRONYM: ALBICAN** **EC FUND: 1137600**

**DG:** REA **Call: FP7-SME-2011** **Thema:** SME-2011-1

**Title:** High-speed all electric bio-cantilever

**Abstract:** Advances in micro-, nano-, and biotechnology put increasing demands on nanoscale microscopy and characterization. Atomic force microscopy (AFM) is one of the highest resolution microscopy methods used in this area. In this project, we will develop a new type of AFM sensor, which will significantly increase the performance of AFM and make it suitable for a much broader range of applications, especially in the life sciences. While traditional AFMs using optical detection of the cantilever sensor, yield very high resolution images, their imaging speed is low, they are difficult to automate and integration with other analysis techniques is limited due to the required optical components. This project aims at removing these limitations for a large area of attractive AFM-applications such as fast analysis in materials science and biological applications. The innovative concept is based on "all electric bio cantilevers", ALBICAN. These cantilevers will use novel granular tunneling resistors (NTR), which are fabricated with a mask-less direct writing technique: focused electron beam induced deposited (FEBID). The AFM cantilever will be equipped with an NTR deflection sensor that directly measures the cantilever signal electrically, which removes the need for optical cantilever detection. Recent improvements in AFM cantilever technology have increased the

imaging speed of AFM by up to two orders of magnitude by miniaturizing AFM cantilevers (SCL-Sensor.Tech., AMG-T). The unique approach in this proposal, which builds on new materials and fabrication processes (Nanoss), will allow the manufacturing of unprecedented small cantilever sensors with vastly superior performance in imaging speed and usability. These cantilevers will be compatible with a wide variety of existing AFMs and applications in materials and life science. Thereby providing a unique technological edge for the involved SMEs, and opening new avenues for the commercialization of their products and technologies.

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**NBR: 286196** **ACRONYM: ESNSTM** **EC FUND: 1376126**

**DG:** REA **Call: FP7-PEOPLE-2011-IAPP** **Thema:** FP7-PEOPLE-2011-IAPP

**Title:** Electron Spin Noise Scanning Tunneling Microscopy

**Abstract:** The final goal of this proposal is to develop an SPM technique which is capable of identifying the type of atom which is under the tip while tunneling. The idea is to exploit the recent success in detection the hyperfine coupling between electron and nuclear spins on the surface and to detect the hyperfine coupling between the electron spin on the tip and a nuclear spin on the surface. ESN-STM is an emerging technique that is capable of single spin detection through modulation at the Larmor frequency of the tunneling current. Recently preliminary studies have shown that using ESN-STM for chemical contrast is a feasible and realistic goal. To achieve this goal, several improvements to the technique are necessary. To this end, we propose to develop and study four advanced ESN-STM setups: 1) at ambient conditions, 2) at ultra-high vacuum (UHV), 3) at low temperature (LT) and 4) LT-UHV. Each of these setups has its own particular advantage. We shall improve the rf recovery system, the spectroscopic analysis and we shall use magnetic tips and quadrature detection. The spectroscopic parameters that we will use are the g factor and hyperfine tensors and the longitudinal and transverse relaxation times. With the new technique, the chemical identity of the spin centers, the surrounding nuclei, the viscosity, the oxidation state and the motion of atoms and molecules etc can be revealed on the single atom and single molecule levels. The spectral parameters will be sensitive to the local environment. This local information is normally averaged out in macroscopic spectroscopy. The (expected) successful improvement of ESN-STM will provide the SME a market for a new technique of studying paramagnetic species on the surface. Yet, a full success of the project in developing an SPM technique with atom identification capability will result in a huge market for a new nano-chemical analysis tool.

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**NBR: 286205** **ACRONYM: BEYONDEVEREST** **EC FUND: 3799998**

**DG:** RTD **Call: FP7-REGPOT-2011-1** **Thema:** REGPOT-2011-1

**Title:** Development of the research potential of the Faculty of Chemistry, Sofia University, in the area of advanced functional materials for successful participation in world-class research at EU level

**Abstract:** This project aims to focus the research potential of the Faculty of Chemistry in Sofia University for performing world-class research in the area of Advanced Functional Materials. The Faculty is leading scientific centre in this area in Bulgaria and in the region, with recognized contributions in the design and characterization of materials with desired chemical, catalytic, biological and optical properties. The high research level in the Faculty was recently acknowledged by the National ranking of Universities - the Chemistry in Sofia University received the highest rank among all research fields in all Bulgarian universities. European evaluators, in the frame of FP7 project "EVEREST", estimated highly the research achievements of the Faculty and noted that the studies in the area of Advanced Materials have the potential to be developed to the level comparable to that of the leading European centers. Based on a thorough SWOT analysis, an institutional strategic plan is defined and implemented in this proposal, aimed at boosting the Faculty excellence and creativity, and building a unique Research and Educational Centre on Advanced Functional Materials in Bulgaria. This objective will be attained by building strategic partnership with leading European research centers: TU Munich (DE), Oxford University (UK), MPI for Polymer Research (DE), University of Turin (IT), ESPCI – Paris (FR); recruitment of five experienced researchers, complementing the Faculty expertise; extending the existing infrastructure with new NMR, TEM and catalytic equipment, needed for cutting-edge research in this area. The project content fits within the thematic priorities of FP7 (NMP) and within the national priority "Materials science and Nanotechnology".

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**NBR: 286262** **ACRONYM: IMPRESS** **EC FUND: 589911**

**DG:** REA **Call: FP7-PEOPLE-2011-IAPP** **Thema:** FP7-PEOPLE-2011-IAPP

**Title:** IMPRoved food safety monitoring through Enhanced imaging nanoplaSmonicS

**Abstract:** The objective of the IMPRESS project is to develop an affordable, portable, multiplexing and flexible Surface Plasmon Resonance (SPR) biosensor device (the IMPRESSOR), based on Plasmore's nanotechnology expertise, to obtain a fast impression of the quality and safety of food. Affordable: the system will be affordable for any small or medium enterprise or even private user, which is producing or distributing or consuming food in any country or region of the world. Portable: the system will be easy-to-use in any environment and must work outside any specialized laboratory. Multiplexed: the system will be able to measure the concentration of many contaminants in a single sample of food and within a single measurement. Flexible: the system is designed to develop

assays according to the wishes of the future users (customized). Fast: measurements are done in minutes and the sample-to-result time will be around 30 minutes. This will allow the real time monitoring of the quality of food. This system will be constituted by two fundamental elements: 1) A disposable biochip customized for the detection of a set of parameters of the quality of the food (e.g. the detection of a set of allergens, toxins or antibiotics) and 2) an electronic reading system enabling the dispensing and the analytical screening of the food sample and the electronic evaluation, storage and communication of the results. Such a system will have a huge impact in the food monitoring protocols and will significantly contribute to the spreading of alternative, fast and reliable analytical methods for food safety control. This will help: - industries and distributors to provide safer and healthier food products, - public regulatory bodies to improve the quality of the food control tests while reducing the assay costs, - end-users and small distributors to verify the quality of their everyday food products

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**NBR: 286285** **ACRONYM: COMPASS** **EC FUND: 816738**

**DG:** REA **Call: FP7-PEOPLE-2011-IAPP** **Thema:** FP7-PEOPLE-2011-IAPP

**Title:** Convergence of magnetics and plasmonics through semiconductors

**Abstract:** A remarbable convergence between the magnetic hard-drive industry and photonics technology is about to take place through the use of lasers to switch magnetisation at the nanoscale using plasmonics powered by a semiconductor laser. This heat assisted magnetic recording will enable storage densities of 1 terabit per square inch. The laser needs to be integrated with the read-write head and needs to operate under severe temperature conditions. The implementation of lasers in manufactured products requires the attainment of new knowledge by the magnetics industry along with the response of the academic industry to the new performance challenges. These goals can only be reached through a strong collaborative programme between industry and academia. The scientific programme is to study the properties of III-V materials to allow higher temperature operation and to study the reliability of lasers when formed by etching. The knowledge will be transferred through the cross-border secondment of staff and researchers between Seagate and the Tyndall National Institute.

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**NBR: 286362** **ACRONYM: NANOSAFEPACK** **EC FUND: 1626339**

**DG:** REA **Call: FP7-SME-2011** **Thema:** SME-2011-2

**Title:** Development of a best practices guide for the safe handling and use of nanoparticles in packaging industries

**Abstract:** The main aim of the NanoSafePACK project is to develop a best practices guide to allow the safe handling and use of nanomaterials in packaging industries, considering integrated strategies to control the exposure to nanoparticles (NP) in industrial settings, and provide the SMEs with scientific data to minimize and control the NP release and migration from the polymer nanocomposites placed on the market. To achieve this aim, a complete hazard and exposure assessment will be conducted to obtain new scientific data about the safety of polymer composites reinforced using nanometer-sized particles. The proposed work will focus on a selected set of nanometer-sized materials (nanoclays and metal oxide NP) relevant to the packaging sector. Full characterisation will be carried out, followed by an exposure measurement in order to identify and quantify any potential particle release in the production and processing activities. A comprehensive hazard assessment will allow the evaluation of effects on human and environmental models, including the development of a NP migration and release index as a hazard indicator. Results from the exposure and hazard assessment studies will be used to compile a risk assessment of the use of NP in the packaging industry. An evaluation of the effectiveness of risk management measures will be undertaken in order to select and design practical and cost effective strategies, which will be easy to implement in the real operational conditions of industrial settings. In addition, as part of this assessment we will conduct a life cycle assessment of nanocomposites, by evaluating their impacts during the processes of manufacture, use and disposal. The key aims of this project are aligned with the needs of the packaging industries in relation to the use of NP as nanoreinforcements the need to improve knowledge and guidance on safety issues for workers and consumers, which must be addressed prior to their widespread use.

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**NBR: 286386** **ACRONYM: UROSENSE** **EC FUND: 2482306**

**DG:** REA **Call: FP7-PEOPLE-2011-IAPP** **Thema:** FP7-PEOPLE-2011-IAPP

**Title:** Biomarker Applications for Nanotechnology and Imaging in Diabetes

**Abstract:** UroSense is a focussed research programme to generate new concepts from knowledge creation to knowledge transfer between innovative academic and dedicated industry partners utilising a systematic intersectoral secondment programme. The programme brings leading edge academic European LifeScience capacities of Diabetes research at Dublin City University, Ireland, together with the high-profile protein research center of University of Luxembourg to establish innovative biomarker utilisation. The nano-biotechnologies developed with established life science applications of Tethis S.p.A of Milano, Italy will be the SME partner to translate findings to microfluidic applications while GE Medical System of Sweden will integrate results to the recently established, robust molecular imaging technologies leading to novel diagnostics for the benefit of the diabetes patient. The Chinese partner is a leading biotech company in Guangzhou who will provide not only validation of results but also to develop access to the fastest

growing global healthcare market benefiting both academic and industrial partners. All European partners are unequivocally in the leading edge in their own sectors sharing the vision of true impacts achieved with a new collaborative working model including efficient knowledge transfer and a shared clear scientific focus. Our consortium is particularly well balanced, focussed and well resourced to cover the value chain from discovery research to applications utilising novel intersectoral collaborations to expedite the utilisation process.

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**NBR: 286413** **ACRONYM: CARBONCOMP** **EC FUND: 1537194**

**DG:** REA **Call: FP7-PEOPLE-2011-IAPP** **Thema:** FP7-PEOPLE-2011-IAPP

**Title:** High-throughput development of carbon-polymer nanocomposites for marine applications

**Abstract:** One of the major obstacles in the effective use of nanostructured carbon as reinforcement in polymer matrix composites is their agglomeration and poor dispersion within the metallic matrix. To overcome this obstacle the proposed project will synthesize and functionalize nanoscaled polymers of carbon nanotubes (mainly) and graphene sheets by employing environmentally friendly and cost-effective methods. Lab-scale production of carbon-based nanocomposites will be initially implemented, primarily for marine coatings but also for other applications where materials performance or biodegradability is of major importance. High purity, low-cost carbon nanotubes and graphene will be tested in order to tailor their chemical functionality towards epoxy resins and biodegradable polyesters. High-throughput methods of carbon nanotubes production, based on fluidized bed technology, will be employed. Functionalization schemes, which can result in fast and economical synthesis of multifunctional nanocomposites, will be carried out by adopting protocols developed by the consortium. The characterization of the multifunctional lab-scale composites will provide a better understanding on how the scale and morphology of reinforcements can promote synergistically materials performance. Modelling of carbon nanotubes and epoxy binder compositions via the novel method of artificial neural network will also contribute to this insight. Up-scaling of the qualified material production processes will be subsequently realized, resulting in the operation of large-scale production lines in the facilities of the industrial partners. The proposed research plan represents a key enabling technology for manufacturers to maximise profit and gain competitive advantages. Optimisation of the processing input parameters will be carried out in order to achieve desired processability (e.g. rheological properties), increased performance (mechanical, electrical or thermal properties) and improved antifouling properties.

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**NBR: 286464** **ACRONYM: NANOBACTERPHAGESERS** **EC FUND: 1625723**

**DG:** REA **Call: FP7-PEOPLE-2011-IAPP** **Thema:** FP7-PEOPLE-2011-IAPP

**Title:** Design of Novel Portable-Sensors Based on Suspension Arrays Composed of Monoclonal Antibody and Bacteriophage Carrying Magnetically Loaded Nanoparticles and Surface Enhanced Raman Spectroscopy"

**Abstract:** In this project, we aim to develop nanotechnology-based systems for detection of pathogenic bacteria in several aqueous media mainly in environmental water based on suspension arrays together with a portable custom-designed detection system. The six objectives (six work packages) are as follows: (i) Nanostructured sensors surfaces, in which electron-beam, photo-, soft and dip-pen lithographies will be applied in the fabrication of functionalized low-cost (disposable) SERS substrates, specially designed for simultaneus Raman and Fluorescence enhancement; (ii) nanosorbents and their mixtures as suspension arrays against the target bacteria for capturing units in which firstly magnetically loaded nanoparticles will be produced and labelled/barcoaded with fluorosence dies and/or quantum dots and then bacteriophages, monoclonal antibodies, and/or aptamers will be immobilized onto these nanoparticles as bioligands to recognize and capture the target bacteria specifically; their mixtures will form the suspension arrays; (iii) target bacteria and bacteriophages; the target bacteria (as water pollutants), are Escherichia coli, Enterococcus species and Bacteroides ovatus; bacteriophages which will recognize these bacteria will be selected/produced as bioligands; (iv) aptamers; they will be selected/modified/produced; (v) sensors/array systems; a portable “Raman Spectrometer/Fluorescence Detector System” will be designed/produced that will be used together with the nanostructured sensors platforms, and finally (vi) validation; the materials and systems developed will be validated. This is a multidisciplinary and technological project and therefore brings together experts from different disciplines both from academia and industry. Basicly, the knowledge that will be developed/ accumulated at lab scale during the project will be transfered to the industrial partners for prototype productions, and then these will bring back to the academical institutions for validation tests.

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**NBR: 286503** **ACRONYM: POWER DRIVER** **EC FUND: 2349895**

**DG:** REA **Call: FP7-SME-2011** **Thema:** SME-2011-1

**Title:** An innovative environmentally friendly thermo-electric power generation system for automotive and marine applications that is powered by exhaust waste thermal energy to reduce fuel consumption.

**Abstract:** Car CO2 emissions are to be limited to 120 g/km for all new passenger cars by 2012. If they are unable to achieve targets, then this may have a significant negative impact on manufacturers. Cars also produce emissions such as Nitrogen oxides, Hydrocarbons,

Carbon monoxide and particulate matter which are subject to tight controls. For marine application, existing and forthcoming legislation is aiming at reducing the emissions of Carbon Monoxide, Hydrocarbons and particulate matter. In addition, concerns about rising fuel costs are driving the need for greater fuel efficiencies. As a result, a disruptive technology step is required that will enable the manufactures or cars and marine engines to meet the forthcoming legislative standards. One very attractive way of achieving this is to generate power from the Internal Combustion Engine (ICE) waste heat. A prototype system created by BMW can generate up to 250W of electricity under normal driving conditions that can cut fuel consumption by up to 2%. However, the thermo-electric materials used for these applications to date have a number of clear limitations as they can be easily thermally damaged, are expensive and only achieve low efficiencies. The POWER DRIVER project aims to overcome the limitations relating to the production of an automotive and marine power generation system by integrating cutting-edge nano-structured silicide and functionally graded telluride thermo-electric materials into a heat exchanger assembly that will enable electrical power to be generated from the exhaust system without affecting back-pressure or engine balance. By doing this, the exhaust system created will offer greatly improved environmental performance due to improved fuel efficiency and reduced emissions (CO2, nitrogen oxides, hydrocarbons, carbon monoxide and particulates) at a cost that is affordable to the end-user. It is predicted that (even if the additional weight of the unit is considered) fuel efficiency will increase by at least 5%, leading to a corresponding 5% reduction in emissions.

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**NBR: 286570** **ACRONYM: ENVIROMONITOR** **EC FUND: 619240**

**DG:** REA **Call: FP7-SME-2011** **Thema:** SME-2011-3

**Title:** Demonstration of an on-site Automated Environmental Monitoring Instrument for real-time detection of hazardous air born particles and Activation of alarms

**Abstract:** This project will demonstrate a novel air quality monitoring systems, which has been developed in a previously EC funded FP7 project Nanoair. This instrument can collect the fine dust particles from the environment in real time, by using X-Ray diffraction (XRD) technology; the collected particles are analyzed qualitative and quantitatively to get detailed information on the phases present in dust, their quantity, and structural/microstructural information. This allows the activation of alarms in case hazardous breathable particles are present in the environment. The entire process is performed in the real time and therefore allows the continuous monitoring of ambient air in the industrial cities, air pollution monitoring in vicinity of industrial site, and air quality at workplaces transforming and manufacturing nanomaterials. The EnviroMonitor project will focus on a wide-range of industrial validation, performance verification against the off-site laboratory equipments “Bench marks” to demonstrate the R&D results achieved in NanoAir. The design for efficient manufacture and

disassembly will be done to reduce the cost of the assembly and comply with standards, and to achieve this we will implantation additional technical solutions. Further we will build up on the market studies we have done in the course of NanoAir project and come up with a detailed market strategy and a business plan. This system will be demonstrated in a wide range of applications, ranging from workplace transforming and manufacturing products from nanomaterials, to city administarions for traffic and industrial pollution monitoring and ambient air quality monitoring.

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**NBR: 286601** **ACRONYM: AQUALITY** **EC FUND: 1128745**

**DG:** REA **Call: FP7-SME-2011** **Thema:** SME-2011-1

**Title:** On-line industrial water quality analysis system for rapid and accurate detection of pathogens

**Abstract:** Currently the identification and quantification of pollutants in water are mostly carried out manually through sampling and subsequent laboratory analysis (off-line analysis), with methodologies of work that involve some significant costs in terms of displacement to sampling points, reagents and specialized personnel dedicated to the operation, leading to time consuming and economically challenging approaches, causing the number of analyses performed to be kept at the bare minimum. The industry therefore is calling for novel, cost-effective solutions to meet these new challenges: we propose to develop an online water monitoring device for microbiological contamination analysis, that allows industries and environmental protection agencies to replace the routine activities of sampling and laboratory testing of pathogens. The new system, which will be produced in two versions, both for online and for offline measurements, will be able to real time monitor the quality of industrial process water and effluents basing on an opto-ultrasonic device and on a lipid-based diagnostic kit. The novelty of our approach is the use of engineered liposomes for detecting bacteria in water: these are nanoparticles formed by a lipid bilayer enclosing an aqueous compartment displaying features that can be different (pH, ionic strength, composition) with respect to the bulk. We will load liposomes with a chromophore and will engineer them in order to make them specifically react with one target bacteria; this is the simple operating system of the AQUALITY system, which is completed by an ultrasonic unit to concentrate bacteria and an optical unit for detecting the sample colour change following to the interaction between liposomes and bacteria.

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**NBR: 286933** **ACRONYM: E-SIGNAGE** **EC FUND: 1168800**

**DG:** REA **Call: FP7-SME-2011** **Thema:** SME-2011-1

**Title:** Electronic paper message board for outdoor use with carbon NanoBud display module and GPRS I/O layer"

**Abstract:** The general objective of the “Electronic paper message board for outdoor use with carbon NanoBud display module and GPRS I/O layer” (E-SIGNAGE) project is to develop a large area, low-cost, high brightness and contrast level, robust, energy efficient (bi-stable; no backlight needed), high information content two-colour electronic outdoor message board that is able to receive data via GSM communication and uses solar energy as a power source. Twist-ball e-paper material developed by Invent Research OÜ (coordinator; SME, Estonia) has the principle capabilities to meet all the quality requirements set by the end-users for active front-plane layers of outdoor electronic signage and message boards (OEMBs). It is potentially highly robust and flexible, has high bi-stability, wide operating temperatures and low production costs. In addition the material is video capable that widens the usage areas of OEMBs. Carbon nanomaterials (Carbon nanotubes and NanoBuds™) developed by Canatu (partner; SME, Finland) have the principle capabilities to meet all the quality requirement set by end-users for the transparent electrode front-plane layers and thin film transistor backplane layers of OEMBs. Canatu’s nanocarbon films are highly robust and flexible, have high carrier mobility, on-off ratios and exceptional optical properties such as high transparency, colour neutrality and excellent index matching. Moreover, Canatu’s Direct Dry Printing technology allows low cost, high volume production. Further development of Invent Research’s and Canatu’s materials in combination with the existing OEMB components will enable the partners of the proposal to develop autonomous and good picture quality OEMB applications. It would be necessary to develop the quality characteristics (brightness and contrast level, resolution, stability in time and in UV light) of the e-paper material (front-plane) for using in OEMBs; develop carbon nanomaterials based front-plane electrodes and backplane transistors; integrate the front-planes/backplanes with other OEMB components; and develop the necessary software.

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**NBR: 287386** **ACRONYM: ADAPTPOLY** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** Adaptive polymer assemblies

**Abstract:** The adaptivity of natural systems is mostly controlled by shifting dynamic supramolecular equilibria or supramolecular recognition based on changes in the environmental conditions. In many adaptive processes, proteins, folded natural polymers, play a vital role to transfer the recognition of a change in environmental conditions into a macroscopic response event. Therefore, the combination of supramolecular chemistry, i.e. the use of non-covalent interactions to self-assemble molecules into larger structures, and polymer chemistry, i.e. covalent linkage of small building blocks to construct large macromolecules, is of utmost importance to develop

novel synthetic adaptive materials, only achievable by joining these two disciplines. The proposed research program on adaptive materials will focus on the following three topics: • Hierarchical supramolecular materials • Supramolecular self-healing materials • Smart nanoparticles Despite the different directions and aims of these three research directions, there will a strong joint basis, namely the combination of defined polymer building blocks and site-specific polymer functionalization with supramolecular moieties. This mutual synthetic approach will facilitate strong interactions between the researchers, which are envisioned to stimulate creativity leading to innovative concepts.

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**NBR: 287430** **ACRONYM: FAWORIT2011** **EC FUND: 120000**

**DG:** REA **Call: FP7-PEOPLE-2011-NIGHT** **Thema:** FP7-PEOPLE-2011-NIGHT

**Title:** A Day of the Researcher under the Magnifying Glass - in and out of Laboratory

**Abstract:** o "CONCEPT" o List of locations involved: Budapest, Miskolctapolca o Venues: Museum of Literature Petőfi, Klebelsberg Community Centre, Campus of BZAKA; the medieval building of Collegium Budapest; Ericsson Building; Campus of BME University; Planetarium; the Cave Bath of Miskolctapolca and its surroundings; secondary school. o Main type of activities planned: shows, demos, exhibitions, competitions, concerts, theatre play, hands on experiments, roundtables, cooking. o TOPICS DEALT WITH • Whole spectrum of research topics including health, biology, physics, chemistry, ICT, nanotechnology, computing systems, laser technology, aeronautics, space research, humanities. o OBJECTIVES o Main objective: enhance public recognition of researchers and their work; o Specific objectives: ▯ show that researchers have a leading role in building a competitive, innovative, knowledge-based society ▯ motivate the youth to choose scientific profession and thereby to facilitate the increasing of the number of researchers in the EU ▯ raise awareness of the European engagement in the field of science and innovation.

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**NBR: 287732** **ACRONYM: ISLA** **EC FUND: 2839995**

**DG:** CNECT **Call: FP7-ICT-2011-7** **Thema:** ICT-2011.3.5

**Title:** Integrated disruptive componentS for 2um fibre LAsers

**Abstract:** 2-micron fibre laser technology has the potential to open a whole new area of ICT & industrial applications. The well-known power scaling advantages, from increased core size & higher non-linear thresholds, offer a tenfold increase in “raw power” compared with current 1-micron technology. Simultaneously, a host of applications specific to this almost unexplored region of the eye-safe spectrum become possible, including:

industrial processing, free-space communications & medical procedures. Undoubtedly more will arise as currently exotic wavelengths become readily available. To date, the lack of suitable components has blocked R&D in this field. However, several recent disruptive component developments have changed the landscape: 1) Ho-doped silica fibre technology has advanced, providing a solid base for development; 2) All-fibre component technology offers integrated functionality; 3) Better isolator materials and new designs offer realistic potential for effective 2-micron devices; 4) New modulator materials & designs allow Q-switches, filters & switches; 5) Carbon nanotube composites offer effective sub-ps modelockers; 6) 790nm diode technology is ripe for development, for optimum direct pumping of Tm. ISLA will seize this opportunity to develop a set of "building blocks" to define an integrated modular common platform for 2-micron Ho-doped fibre lasers consisting of compatible and self-consistent fibre, components and laser diodes. Not only will advances beyond the state-of-the-art in each of these component areas be achieved, but this will be attained through a coordinated program to deliver a genuinely integrated technology platform. Continuous wave, pulsed and short pulse lasers will be demonstrated through industrial applications (transparent plastic cutting and PV cell scribing). An industrial user group will identify new applications and aid exploitation routes, and the project results will be promoted within recognised standards bodies to benefit the whole of EU industry

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**NBR: 287874** **ACRONYM: FIREFLY** **EC FUND: 3419215**

**DG:** CNECT **Call: FP7-ICT-2011-7** **Thema:** ICT-2011.3.5

**Title:** Multilayer Photonic Circuits made by Nano-Imprinting of Waveguides and Photonic Crystals

**Abstract:** The objective of FIREFLY is the introduction of novel polymer waveguide and photonic crystal structures based on highly structured 3D nano-hybrids into industrial applications by using a new cost effective production process for larger scale manufacturing. The target applications are optical waveguides and photonic structures for the manipulation of light in, for example, optical interconnects. The optical interconnects technology will initially be applied for data communication in high performance supercomputers, and eventually these optics will also find their way into high-end server systems, mid-range servers and in consumer-like applications such as high-end multimedia devices. Waveguides and photonic crystals based on polymers have been proven in a laboratory environment to be interesting technologies for light management. In most cases these structures are manufactured on small scale. We propose the use of a relatively new technology to manufacture these structures on a larger scale. The nano-hybrids will be manufactured using a combined approach of nano-imprint process in a polymer resins and self assembly of material in the polymer nano-structures. The nano-structures will be filled with new modified polymer compositions having a high refractive index and optical clarity at relevant wavelengths, necessary for waveguides, and with inorganic

nanoparticles to prepare photonic crystals, for the manipulation of light for guiding the light in waveguides through sharp horizontal and vertical bends. Some material developments are needed: new silicone polymers that will be modified for improved optical properties such as low optical loss and tuneable refractive index, and new inorganic particles that will combine a high refractive index with a very high level of monodispersity. The manufacturing process will be suitable for up-scaling to an industrial process. This new bottom-up approach will enable the development of hybrid materials with new optical properties.

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**NBR: 288166** **ACRONYM: TOUCHMORE** **EC FUND: 2899863**

**DG:** CNECT **Call: FP7-ICT-2011-7** **Thema:** ICT-2011.3.4

**Title:** Automatic Customizable Tool-chain for Heterogeneous Multicore Platform Software Development

**Abstract:** Recent trends in embedded system architectures brought a rapid shift towards multicore, heterogeneous and reconfigurable platforms. This makes chip design enormously complex and imposes a large effort for the programmers to develop their applications. For this reason, new and more efficient tools for software development are needed to ensure software productivity and time to market of new applications. In particular, the automation of the software design process starting from high level models all-the-way down to a customized and implementation on specific architectures is a key factor to increase programmer productivity. The ToucHMore project will develop software tools that facilitate energy efficient and robust software for Heterogeneous Multicore Systems (HeMCS) with the goal to reduce the time-to-market in the design of such systems by at least 15%, as well as the cost of software design through the automation process by 20%. In more detail, the center of the methodology is the high level modeling language (UML/SysML) that will be used to describe the target platform and application. High level modelling allows an architectural independent description of the application and for this reason it is prone to customization for different architectural templates. In ToucHMore, customization will be performed in an automated way through automated generation of parallel code for multicore tiles and the required mechanisms to manage reconfigurable DSPs/accelerators. In addition, the ToucHMore tool-chain customization environment will focus on energy efficiency and robustness of the generated code, where the uncertainties due to fabrications of transistors in nanometer technologies will be hidden, thus mitigating their impact in terms of energy and performance. From a research perspective, ToucHMore is a pioneering project from the perspective of taking a pragmatic approach to bring variability issues into the software design flow. Together with the automatic toolchain customization strategy coupled with high level modeling, these contribution will give the European research on embedded software a leading position. The project results will be commercially exploited by the SME ATEGO as a specialised software tool vendor and by the company

AKHELA that is an IT services and Embedded Systems provider to large scale companies in areas such as automotive, avionics and consumer electronics. The project results will strengthen their position in their respective markets by enabling the production of products faster and more timely than the world wide competitors and it is expected that they will have a manifold return on their investment. The five research institutions will use the gained knowledge to enrich their teaching and research activities enabling them to stay at the forefront of technology and substantiating their prestige in the scientific community.

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**NBR: 288263** **ACRONYM: NANO-VISTA** **EC FUND: 3020000**

**DG:** CNECT **Call: FP7-ICT-2011-7** **Thema:** ICT-2011.3.5

**Title:** Advanced photonic antenna tools for biosensing and cellular nanoimaging

**Abstract:** Advances in the fields of molecular and cell biology are strongly coupled to the implementation of photonic tools that allow highly-sensitive measurements in living cells at high molecular concentrations and at the nanometre scale. The goal of NANO-VISTA is to exploit novel concepts of photonic antennas to develop a new generation of bionanophotonic tools for ultrasensitive detection, nanoimaging and nanospectroscopy of biomolecules, both in-vitro and in living cells. By taking advantage of the extraordinary field enhancement, directionality and nanofocusing of photonic antennas, our approach will allow single biomolecule detection in ultra-reduced detection volumes, including living cells. The project focuses on three main objectives: a) to pioneer the development of novel photonic antennas for ultrasensitive detection in fluids and simultaneous spatio-temporal superresolution in living cells; b) to develop high-throughput large-scale nanofabrication of photonic antennas fully compatible with life science applications; c) to demonstrate the functionality of the technology for biosensing and transferability into potential market products, and for nanoimaging and nanospectroscopy on living cells. Thus, NANO-VISTA is fully targeted to the development of disruptive photonic technologies fundamental in strategic applications such as medicine and biology. To maximise the chances of success we have chosen for an interdisciplinary, trans-national and multi-institutional partnership (including a SME and a Medical Centre). True European specialists, with long standing expertise in the fields of nanophotonics, photonic antennas, large-scale nanofabrication approaches and nanoimmunologists are concentrated in this proposal strengthening European research cohesion. In the mid-long term we expect that both, cell biologists as well as industrial sectors (biophotonic, microscopy and biotechnology enterprises) will benefit from this new technology

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**NBR: 288318** **ACRONYM: NIRVANA** **EC FUND: 2607000**

**DG:** CNECT **Call: FP7-ICT-2011-7** **Thema:** ICT-2011.3.2

**Title:** NINE-AXIS INERTIAL SENSOR BASED ON PIEZORESISTIVE NANO-GAUGE DETECTION

**Abstract:** With the recent introduction of MEMS in consumer applications (mobile phone, gaming…) the market for low cost and low power consumption multi-axis inertial sensors has boomed over the last five years. These sensors have generated huge business opportunities, with $M.1900 revenues in 2009 at the MEMS level. Beyond consumer applications, there are many other growing mass market applications like IPTV remote control, sport or eHealth. For these domains, lower consumption, miniaturization, integration and ultimately lower cost of production are essential to address and dominate this market. The same applies for high end niche markets such as implantable sensors in medical field. To address these needs, NIRVANA project aims to develop a very low cost and very low power consumption 9-axis inertial sensor based on a new concept and technology using nano-scale detection means. The idea is to take advantage of the very high sensitivity and low impedance of silicon nano-wire gauge to optimize the dimensions and the integration of the sensor and to reduce the overall power consumption. At this end, innovative sensor designs, disruptive technology (mixing MEMS and NEMS technologies, and including packaging with TSV), and new electronics architectures will be developed in this project. The targeted goal is to validate the integration of 9-axis sensor based on nano-wire gauge detection, having a surface and cost 2 to 4 times less than the current commercial components and with power consumption 3 to 5 times lower. Special emphasis will also be put on the characterization and reliability of these sensors. To ensure the success of this ambitious project, a consortium has been established, with leading research groups (LETI, POLIMI, FhF-IIS) and key industrials partners: Two end-users (MEDEL and MOVEA), and the inertial MEMS manufacturer world leader in the consumer segment (STM), will guarantee the real and prompt exploitation of the developments and results of the NIRVANA project

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**NBR: 288481** **ACRONYM: SOI-HITS** **EC FUND: 3025382**

**DG:** CNECT **Call: FP7-ICT-2011-7** **Thema:** ICT-2011.3.2

**Title:** Smart Silicon on Insulator Sensing Systems Operating at High Temperature

**Abstract:** SOI-HITS is an ambitious, innovative and timely STREP project that will enable significant energy consumption savings and reduce waste in processes such as: combustion in domestic boilers; oil & gas storage and transportation; CO2 capture and sequestration. It aims to deliver at least 15% saving of energy consumption in domestic boiler industry (~40 million domestic boilers in the EU with a growth rate of 15% per year); equating to 3.6 billion Euros saved per year. For this ambitious goal, SOI-HITS will develop innovative

CMOS-compatible, Silicon-on-Insulator (SOI) integrated smart microsensor systems, capable of multi-measurand (water vapour, temperature, gas, flow, UV/IR) detection under harsh environment conditions (to 225oC, high water vapour level). SOI technology has several advantages over bulk silicon: enhanced electro-thermal isolation giving lower power consumption, ease of forming arrays of MEMS membranes, option of tungsten as a high temperature CMOS metal, direct integration of high-performance temperature and UV optical solid-state sensors. The smart multisensor chip will comprise multiple micro-hotplates with tungsten micro-heaters onto which selective nanostructured and thin film metal oxide sensing layers have been deposited. For the gas sensors (CO2 (concentration 6-10%, CO (0-1000ppm), and H2S (0-100ppm)), we will achieve fast thermal response time of a few ms and loss per micro-hotplate below 0.2mW/oC. Water vapour sensors, flow sensors (for liquid & gas) and precision on-chip temperature controllers will be also integrated. On-chip processing electronics, including drive circuitry, filters, amplifiers, processing circuits and analogue to digital interfaces, operating at 225oC, will be developed. The extension of the SOI platform to optical detectors, such as UV photodiode flame detectors and IR combined sources/detectors, will be explored. Finally development of a High Temperature SIP (system in a package) will enable real-world demonstrators.

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**NBR: 288531** **ACRONYM: NANOTEC** **EC FUND: 6630000**

**DG:** CNECT **Call: FP7-ICT-2011-7** **Thema:** ICT-2011.3.2

**Title:** Nanostructured materials and RF-MEMS RFIC/MMIC technologies for highly adaptive and reliable RF systems

**Abstract:** RF communication and remote sensing (radar/radiometric) systems are facing the demands of increasing complexity/number of frequency bands, increased bandwidths and higher frequencies for higher data throughput, while at the same time the power consumption, the form factor of the systems, and the overall system costs must decrease. Future smart micro-/mm-wave systems will have to achieve self-reconfigurable operations for real-time efficient self-optimization of their performance. For such adaptive systems, high-performance tuning/switching components and strategies for building monolithically integrated (miniaturised) reconfigurable active RF circuits and front-ends are needed.The NANOTEC project aims to generate innovative approaches towards novel RF/mm-wave systems with increased functionality and potentially lower cost addressing future needs of European industry. NANOTEC will develop 4 Demonstrators (1:10-24 GHz reflect arrays for aerospace, 2:71-86 GHz frequency-agile LNA/PA for E-band PtP communication, 3:94 GHz high-sensitivity front-ends for passive imaging and 4:140 GHz radar front-ends for active imaging) with advanced functionalities based on enabling technologies and via monolithic integration of high-performance RF-MEMS switches in GaN/GaAs/SiGe IC foundry processes.NANOTEC will aim to improve reliability of RF-MEMS by using NANO

structured materials and to demonstrate added-value by employing the proposed GaN/GaAs/SiGe MEMS-ICs for 10-140 GHz applications.The emergence of European sources (SiGe/GaAs/GaN MEMS-IC foundries) will play a key role towards increasing the availability of RF-MEMS TEChnology and related products (thus shorten time-to-market).If successful, NANOTEC will also lead to improved safety/security thus creating novel business opportunities/jobs for existing/new companies in Europe.The NANOTEC consortium consists of 18 partners (7 countries) incl. some European stakeholders in the field of communications, avionics, space and security

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**NBR: 288670** **ACRONYM: NEMIAC** **EC FUND: 2440000**

**DG:** CNECT **Call: FP7-ICT-2011-7** **Thema:** ICT-2011.3.2

**Title:** Nano-Electro-Mechanical Integration And Computation

**Abstract:** The first fully electronic vacuum tube based computer ENIAC (Electronic Numerical Integrator And Calculator) consumed 200 kW of power. Since then power consumption has become the major bottleneck in state-of-the-art microelectronic technology as leakage power is approaching dynamic power in nanometer technologies. This is particularly an issue for emerging applications for smart components such as autonomous sensor nodes, wireless communications devices, and novel mobile computers which all require logic circuits with dramatically improved energy efficiency. NEMIAC (Nano-Electro-Mechanical Integration And Computation) proposes a solution based on nano-electromechanical (NEM) switches with practically zero leakage, abrupt switching and high on-current suitable for stand-alone embedded systems as well as 3-D integration with CMOS. The potential benefits of a mature technology are an order of magnitude improvement in energy efficiency with no performance penalty in a variety of processing applications, and radiation-resistant and higher temperature operation than CMOS. Within NEMIAC, NEM switches suitable for digital logic design will be explored and developed, along with innovative circuit architectures for low power smart components and smart systems applications. The new switches will have a footprint below 3µm×3µm and targeted switching times of the order of 10 ns. Functional logic blocks based on NEM relays will then be implemented. Design and simulation methodologies will be developed for the new mechanical logic elements and used to explore the design-space for the target applications and demonstrate a small microprocessor.

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**NBR: 288827** **ACRONYM: SMAC** **EC FUND: 8197000**

**DG:** CNECT **Call: FP7-ICT-2011-7** **Thema:** ICT-2011.3.2

**Title:** SMArt systems Co-design

**Abstract:** Smart systems consist of heterogeneous subsystems and components providing different functionalities; they are normally implemented as “Multi-Package on a Board”. To fully exploit the potential of current nanoelectronics technologies, as well as to enable the integration of existing/new IPs and “More than Moore” devices, smart system miniaturization and “Multi-Chip in a Package” implementation are unavoidable. Such goals are only achievable if a flexible software platform (i.e., the SMAC platform) for smart subsystems/components design and integration is made available to designers and system integrators. The platform must include methodologies and EDA tools enabling multi-disciplinary and multi-scale modeling and design, simulation of multi-domain systems, subsystems and components at all levels of abstraction, system integration and exploration for optimization of specific metrics, such as power, performance, reliability and robustness. Key ingredients for the construction of the SMAC platform include: (1) The development of a cosimulation and co-design environment which is aware (and thus considers) the essential features of the basic subsystems and components to be integrated. (2) The development of modeling and design techniques, methods and tools that, when added to the platform, will enable multi-domain simulation and optimization at various levels of abstraction and across different technological domains. The SMAC platform will allow to successfully address the following grand challenges related to the design and manufacturing of miniaturized smart systems: (1) Development of innovative smart subsystems and components demonstrating advanced performance, ultra low power and the capability of operating under special conditions (e.g., high reliability, long lifetime). (2) Design of miniaturized and integrated smart systems with advanced functionality and performance, including nanoscale sensing systems, possibly operating autonomously and in a networked fashion

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**NBR: 288869** **ACRONYM: NAVOLCHI** **EC FUND: 2400000**

**DG:** CNECT **Call: FP7-ICT-2011-7** **Thema:** ICT-2011.3.5

**Title:** Nano Scale Disruptive Silicon-Plasmonic Platform for Chip-to-Chip Interconnection

**Abstract:** The NAVOLCHI project explores, develops and demonstrates a novel nano-scale plasmonic chip-to-chip and system-in-package interconnection platform to overcome the bandwidth, foot-print and power consumption limitations of todays electrical and optical interconnect solutions. The technology exploits the ultra-compact dimensions and fast electronic interaction times offered by surface plasmon polaritons to build plasmonic transceivers with a few square-micron footprints and speeds only limited by the RC constants. Key elements developed in this project are monolithically integrated plasmonic lasers, modulators, amplifiers and detectors on a CMOS platform. The transceivers will be interconnected by free space and fiber connect schemes. The

plasmonic transceiver concept aims at overcoming the challenges posed by the need for massive parallel interchip communications. Yet, it is more fundamental as the availability of cheap miniturized transmitters and detectors on a single chip will enable new applications in sensing, biomedical testing and many other fields where masses of lasers and detectors are need to e.g. analyze samples. Economically, the suggested technology is a viable approach for a massive monolithic integration of optoelectronic functions on Si substrates as it relies to the most part on the standardized processes offered by the silicon industry. In addition, the design and production cost of plasmonic devices are extremely low and with the dimension 100 times smaller over conventional devices they will require much lower energy to transfer data over short ranges of multi-processor cluster systems. The project is disruptive and challenging but it is clearly within the area of expertise of the consortium. It actually builds on the partners prior art such as demonstration of the first nano-scale plasmonic pillar laser. This project has the potential to create novel high-impact technologies by taking advantage of the manifold possibilities offered by plasmonic effects.

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**NBR: 288981** **ACRONYM: EST-FRAME** **EC FUND: 1499273**

**DG:** RTD **Call: FP7-SCIENCE-IN-SOCIETY-2011-1** **Thema:** SiS.2011.1.1.1-4

**Title:** Integrated EST Framework

**Abstract:** The aim of the EST-Frame project is to contribute to socially robust and ethically sound research and technology development by providing further methodological development of appropriate tools for social impact assessment and technology evaluation. The project will appraise current assessment methods for evaluating emerging science and technology with the objectives of mapping their strengths and weaknesses and determining their appropriate application domains. It will examine the current policy context for emerging science and technology (EST) policy advice and will identify future trends and needs that should be considered. The project will, in close dialogue with end users, also identify to what extent – and in what contexts –a framework of a more integrated nature can be applied, and it will examine the appropriate position that such an integrated framework can operate in, within a context characterised by internationalisation, market politics, and new forms of public-private partnerships in technology governance. Finally, this work will result in the design of a flexible, integrated framework that is intended to facilitate holistic societal dialogue and reflection and policy advice on emerging science and technologies. This integrated framework can be applied by policy forming actors (economic councils; ethical councils; technology appraisal institutes, government technology assessment boards, etc.) who are involved in the process of conducting analyses and coordinating policy deliberations on the broad range of science and technological developments. The project will use four examples of emerging science and technologies – (1) nanotechnology in food production, (2) synthetic biology, (3) biofuels and (4) security in emerging ICTs – to

determine how current frameworks are applied to assess social impacts and then evaluate these assessments in light of the integrated framework. An added value of the project is policy relevant advice on the four cases.

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**NBR: 289033** **ACRONYM: DYNANO** **EC FUND: 3825237**

**DG:** REA **Call: FP7-PEOPLE-2011-ITN** **Thema:** FP7-PEOPLE-2011-ITN

**Title:** DYNAMIC INTERACTIVE NANOSYSTEMS

**Abstract:** The key and direct objective of DYNANO is to provide training with a deep knowledge and expertise on Dynamic Interactive Nanosystems for biomedical and biotechnological applications on the basis of the existing scientific and technological areas: dynamic chemistry / glycosciences / biology / nanosciences. DYNANO will expose researchers in training to the process of design, generation, optimization and biomedical / biotechnological / industrial applications of a variety of functional systems like membranes, biosensors, microarrays and nanodevices. This multidisciplinary approach brings together scientists and key private industry players with complementary backgrounds, as essential developmental pillars. DYNANO is a 48-month Initial Training Network aiming to provide: • Advanced inter-disciplinary training in an integrated setting using a dynamic chemistry / glycosciences / nanotechnology platform. • International and inter-cultural training for researchers in a network of highly skilled research groups throughout Europe. • Inter-sectorial training between academic groups and participating industry Partners, with special emphasis on corporate R&D and entrepreneurship. • Advanced knowledge from the design and generation of dynamic nanosystems adapted to glycoscience applications. • New applications of dynamic nanosystems in biomedicine / biotechnology / industry, potentially leading to new products.

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**NBR: 289092** **ACRONYM: ROBOLAW** **EC FUND: 1497966**

**DG:** RTD **Call: FP7-SCIENCE-IN-SOCIETY-2011-1** **Thema:** SiS.2011.1.1.1-3

**Title:** Regulating Emerging Robotic Technologies in Europe: Robotics facing Law and Ethics

**Abstract:** The main objective of the research in this proposal is to investigate the ways in which emerging technologies in the field of (bio-)robotics (e.g. bionics, neural interfaces and nanotechnologies) has a bearing on the content, meaning and setting of hard versus soft law. We will research the ways in which regulation (both in terms of soft and hard law) may be affected by, and even in need of adjustment in light of, advances in robotics, with a special focus on human enhancement. To do so we will analyse the current state-

of-the-art of legislation and regulation pertaining to robotics, and we will point towards areas of regulation that are in need of adjustment or revision due to the advent of emerging robotics technologies. Moreover, we will study the interrelations between technical, legal and moral norms in this field, in order to define what could be the best balance between them, and to promote a technically feasible, yet also ethically and legally sound basis for future robotics developments. Uncovering ethical values embedded into robotics technologies, and ethical consequences arising from their use, is another key element of this research, therefore. The most important outcome of the research will consist of a "White Book on Regulating Robotics", which will containing regulatory guidelines for the European Commission, in order to establish of a solid framework of 'robolaw' in Europe.

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**NBR: 289198** **ACRONYM: ARDENT** **EC FUND: 3922553**

**DG:** REA **Call: FP7-PEOPLE-2011-ITN** **Thema:** FP7-PEOPLE-2011-ITN

**Title:** Advanced Radiation Dosimetry European Network Training initiative

**Abstract:** ARDENT is a multi-site ITN that will provide training for 15 ESRs in the field of advanced instrumentation for radiation dosimetry. This training initiative is founded on actions aiming to strengthen and enrich international cooperation amongst all partners involved (7 Full and 5 Associate), promoting the technological transfer of the research results to industry through the active involvement of four industrial partners (3 Full and 1 Associate). The project focuses on three main technologies: gas detectors (gas electron multipliers and tissue equivalent proportional counters), solid state detectors (Medipix and silicon microdosimeters) and track detectors (CR-39 and nanodosimeters). It addresses the development of these types of instruments for mixed-field dosimetry, microdosimetry, spectrometry, beam monitoring. The applications range from the characterization of mixed radiation fields around particle accelerators, in particular accelerators for cancer therapy with electron, proton and carbon ions, on board commercial flights and in space, to the measurement of the secondary dose to patients undergoing radiation therapy, and can equally be employed for measurement of the properties of clinical hadron beams. The overall goal of ARDENT is to train young researchers in a sector that is very important for the future of European research, at the same time fostering the development of the European private sector. Some of the institutes involved in ARDENT have a long-standing bilateral collaboration but at present there is no global collaboration amongst all partners involved in this ITN. ARDENT therefore also represents an excellent opportunity to strengthen existing links and to create a new network among all partners. A series of network-wide activities, in terms of both training and collaborative research, and a strong programme of secondments are an essential part of this ITN. Several outreach activities complete the ARDENT programme.

**NBR: 289219** **ACRONYM: BIOSURFING** **EC FUND: 2970613**

**DG:** RTD **Call: FP7-KBBE-2011-5** **Thema:** KBBE.2011.3.3-03

**Title:** New-to-nature biosurfactants by metabolic engineering: production and application

**Abstract:** This project aims to create new-to-nature and tailor-made biosurfactants through metabolic engineering of the unconventional yeast Candida bombicola. Biosurfactants produced by fermentation offer a worthy alternative to traditional surfactants, which are typically derived from non-renewable petrochemical resources and may cause environmental problems due to their ecotoxicity and poor biodegradability. Despite the clear advantages of biosurfactants, their overall use is hampered by the lack of structural variation. This is in sharp contrast to chemically produced surfactants where one can introduce variation by simply changing the building blocks. Structural variation is essential as (bio)surfactants find application in a very broad range of sectors. This project aims to alleviate this fundamental limitation by developing a generic biotechnological production technology for glycolipid biosurfactants. This will in turn significantly broaden the range of commercial biosurfactants, satisfying the need for structural diversity in the market. It is expected that this technology will result in a breakthrough penetration of glycolipid biosurfactants in the overall surfactant market, in this way helping to build the bio-based economy. Indeed, biosurfactants are a promising target for the biobased economy as the world surfactant production exceeds 13 Mton/year and is meanly based on petrochemical raw materials. The very efficient biosurfactant producing yeast C. bombicola will be metabolically engineered such that all structural parts of the glycolipid biosurfactant molecule can be controlled: fatty acid tail, sugar moiety, acetylation and lactonization. New technology for metabolic engineering of unconventional organisms such as the use of meganucleases will be developed and strains will be evaluated by several “omics” approaches: proteomics, transcriptomics and metabolomics . Metabolically engineered production strains equipped with new combinations of genes and pathways will synthesize tailor-made and new-to-nature biosurfactants. For each target molecule, a fermentation process will be developed and the molecules will be evaluated for various applications (cleaning and cosmetics, medics and nanoscience). The project thus covers the whole innovation chain from basic research to production and application development. To achieve this goal, a complementary consortium of European academic and industrial partners (including a large participation of SMEs) has been formed that covers the whole range of required expertises. In brief, BIOSURFING promotes the use of biotechnology as a valid production process for novel industrial compounds, the development of biotechnological platform technologies and robust microbial industrial production systems. Moreover, the projects helps to realise the objectives of EU environmental and innovation policy initiatives, such as the Environmental Technology Action Plan and the EU Strategy for key enabling technologies.

**NBR: 289454** **ACRONYM: NANODRUG** **EC FUND: 3752752**

**DG:** REA **Call: FP7-PEOPLE-2011-ITN** **Thema:** FP7-PEOPLE-2011-ITN

**Title:** Novel nanoparticles for drug delivery to the skin

**Abstract:** The aim of the NANODRUG Network is to contribute to the defragmentation of the emerging field of nanomedicine by providing a unique training programme that will cover all different aspects ranging from NP synthesis and characterisation, drug delivery, molecular biology to nanotoxicology, preclinical studies, risk assessment and nanotechnology policy making. The NANODRUG training program is far superior to any training that individual partners can provide and will equip researchers with innovative and creative skills and enhance their career prospects in the public and private sectors. The scientific aim of this research training network is to develop and characterise a selected set of novel intelligent nanomaterials and to study their suitability as novel drug delivery systems targeting inflammatory skin diseases. The development and use of the NP described in this project aims to overcome the current difficulties that limit the applications of NP to skin drug delivery. The unique physico-chemical properties of these novel NP such as ultra small size, large surface to mass ratio, high reactivity and the capability to tailor them to applications will ensure that when complexed with drugs the pharmacokinetics and therapeutic index of the delivery systems can be significantly improved compared to the free molecules and the capability to pass the SC of the skin greatly enhanced. This project brings together 6 academic groups and 2 industrial teams as full partners, complemented by 3 associate partners, one of which is an industrial team, distributed over a total of 6 EU member states and 1 non-ICPC country. The consortium brings together groups with a very interdisciplinary expertise ranging from polymer synthesis and characterisation, computational modelling and physicochemical characterisation of materials to bioavailability, NP formulation, drug distribution and nanotoxicity, genetics, drug delivery and clinical dermatology.

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**NBR: 289795** **ACRONYM: S^3NANO** **EC FUND: 4000024**

**DG:** REA **Call: FP7-PEOPLE-2011-ITN** **Thema:** FP7-PEOPLE-2011-ITN

**Title:** Few Spin Solid-State Nano-systems

**Abstract:** This network brings together an exceptionally strong group of world leading experts in nano-science and technology in order to achieve breakthroughs in understanding and successful utilisation of nanoscale systems in future devices. The focus of the consortium is on few spin nano-systems in solid-state materials including III-V

semiconductors and Carbon-based structures: carbon nano-tubes, graphene and diamonds. Such wide material base emphasizes the truly intersectoral character of this collaboration opening opportunities for crossing the boundaries between several areas of solid-state physics and technology. In order to ensure the highest impact of this collaboration in the emerging supra-disciplinary field of physics and applications of spin nano-systems, we bring together the expertise of the world top class research institutions and industry from 4 European countries. The network will deliver top international level multidisciplinary training to 11 early stage researchers and 5 experienced researchers, offering them, in particular, an extended program of multinational exchanges and secondments. The research and development under this network will undertake a broad scope of tasks important for implementation of spin nano-systems in future devices, such as non-volatile ultra-compact memories, nano-magnetometers, spin qubits for quantum information, and high-efficiency single photon sources. The objectives of the network include: (1) Realization and optical control of coherent single spins in nanostructures; (2) Spin-orbit interaction and spin-orbit qubits in nanostructures; (3) Advanced techniques for manipulation of nuclear spins on the nanoscale; (4) Generation of long-distance entanglement between single spins.

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**NBR: 289829** **ACRONYM: SUSFOFLEX** **EC FUND: 2954436**

**DG:** RTD **Call: FP7-KBBE-2011-5** **Thema:** KBBE.2011.2.3-03

**Title:** SMART and SUSTAINABLE FOOD PACKAGING UTILIZING FLEXIBLE PRINTED INTELLIGENCE and MATERIALS TECHNOLOGIES

**Abstract:** Scientists and business oriented organizations all have a responsibility in the technology driven sustainable development. The SusFoFlex project has put a rather ambitious objective forward, specifically to deliver a technology which targets the customers with exciting new features and which could possibly yield new production-consumption patterns by using cutting edge sustainable technologies with smart features. The development of novel packaging solutions that will have the following characteristics a. To be sustainable: innovative packaging materials and additives developed from eco-friendly, bio degradable materials obtained from organic agro-food by-products; or traditional packaging materials combined with the former solutions so that their employed amount could be reduced b. To be able to increase/improve the shelf-life of the packaged food: packaging materials with improved barrier and antioxidant properties c. To be able to reduce food losses: thanks to the ability to extend the shelf-life, and/or incorporation of nanomaterials based sensor array (intelligent packaging) The development of a methodology that could be flexibly applied to different food categories a. Identification of food storage requisites b. Identification of properties of traditional packaging solutions used at present for that food c. Development of sustainable materials with competitive performance d. Development of innovative solutions with improved performances e. Industrial small-scale demonstration of the

results The consortium will investigate different traditional packaging materials (PP/PE) and identify the key areas where improvement in terms of barriers and smart functions can be made by using natural additives, filler and nanomaterials (natural antioxidant extracts, cellulose-based bionanocomposite, nano-silicates, edible nanolaminate coatings), by PLA films, and by developing nanomaterials based sensor array that can gain information on the condition of the product.

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**NBR: 290023** **ACRONYM: RADDEL** **EC FUND: 3849760**

**DG:** REA **Call: FP7-PEOPLE-2011-ITN** **Thema:** FP7-PEOPLE-2011-ITN

**Title:** Nanocapsules for targeted delivery of radioactivity

**Abstract:** The consortium RADDEL (RADioactivity DELivery) has a research-based approach for the training of the new generation of scientists in the development of novel functional nanomaterials . A well structured training program will be provided with a balanced combination of local and network-wide training through secondments, joint network meetings, workshops, schools, industrial training and the final network conference. The research program focuses on the design, synthesis, characterisation, pharmacological studies and dosimetry calculations of nanocapsules that seal in their interior radioactive materials for biomedical applications in the areas of cancer diagnosis and therapy. After sealing the chosen radionuclides, the external walls of the nanocapsules will be decorated with biomolecules to render them biocompatible and for targeting purposes. In a recent study we have recently observed that these nanocapsules allow the delivery of unprecedented radiodosage and remain stable for extended periods thus guaranteeing essentially zero leakage of the radionuclides. Surface functionalisation of these nanocapsules offers versatility towards modulation of tissue biodistribution of the radioemitting crystals in a manner determined by the nanocapsule that delivers them. The delivery of radioactivity takes place through the walls of nanocapsules (carbon) and release of the encapsulated radionuclides is therefore not needed and certainly not desired. The present research objectives go beyond the-state-of-the art in the field and innovative products and solutions are expected.

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**NBR: 290158** **ACRONYM: NANOMOTION** **EC FUND: 3350360**

**DG:** REA **Call: FP7-PEOPLE-2011-ITN** **Thema:** FP7-PEOPLE-2011-ITN

**Title:** NANOELECTROMECHANICAL MOTION IN FUNCTIONAL MATERIALS

**Abstract:** The focus of modern solid-state technology is currently shifting from the single property (electric, magnetic, and elastic) to a coupling of different fields where a coupled

materials response can be either used for their characterization or as a basis of novel applications. In the last few years, it became clear that the coupled electromechanical response of the materials (i.e., mechanical deformation under applied electric bias) can be not only used as an universal tool for studying diverse materials classes at the nanoscale but is becoming indispensable for the development of next generation of multifunctional materials (piezoelectrics, ferroelectrics, multiferroics, ionic conductors, and polar biomaterials) and composites on their base. Novel nanoelectromechanical tools (Piezoresponse Force Microscopy - PFM, Electrochemical Strain Microscopy - ESM, and as well their combination with traditional Scanning Probe Microscopies - SPM) have been introduced for studying emergent materials and applications. This has recently led to the substantial progress in the development of novel multiferroics, photovoltaic, biopiezoelectrics and battery materials. The emergent field of nanoelectromechanics requires coordinated action at the European level as further progress in this field largely relies on the education and dissemination of best practices in application of PFM/ESM to a large number of functional materials NANOMOTION is intended to train the next generation of engineers and technologists in the fundamental aspects of the nanoelectromechanics, to apply advanced PFM/ESM tools to study a wide range of functional materials in collaboration with interested industrial partners and to create a European-based pool of researchers in this area.

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**NBR: 290161** **ACRONYM: CQOM** **EC FUND: 5717363**

**DG:** REA **Call: FP7-PEOPLE-2011-ITN** **Thema:** FP7-PEOPLE-2011-ITN

**Title:** Cavity Quantum Optomechanics

**Abstract:** Over the past year a new research field has emerged: cavity Optomechanics which brings the quantum regime of mechanical oscillators in reach and may allow to explore new fundamental measurements concepts, may lead to novel transducers and test quantum mechanics on a macroscopic scale. In this research field, which utilizes mechanical oscillators coupled to laser fields, Europe has played a pioneering role. The distinguishing feature of this ITN training network is that the partners are active in this research field (cavity Optomechanics), which facilitates and indeed leverages the collaborative effort and will make this ITN highly effective. Cavity optomechanics is moreover a field which is highly faceted in terms of the required and offered training skills that spans quantum optics, nanofabrication, finite element simulation and cryogenic expertise and techniques as well as quantum theory. To effectively train new students it is therefore pivotal to train students in all relevant skills and techniques and theory. The realization that a single group is much less efficient than a consortium is the major driving force behind the ITN network. It will provide a streamlined, high quality-training program that offers a remarkably diverse set of skills. This training program will be of immediate benefit to the partners that will thereby obtain a superior training of their PhD students, which therefore provides a build-in mechanism that will ensure the

effective realization of the proposed ITN training program and it success. The existence of such a training program, which will be opened to international groups, will contribute to the visibility of the EU cavity optomechanics community in an international setting.

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**NBR: 290248** **ACRONYM: MAG(NET)ICFUN** **EC FUND: 4425987**

**DG:** REA **Call: FP7-PEOPLE-2011-ITN** **Thema:** FP7-PEOPLE-2011-ITN

**Title:** Functionalized Magnetic Nanoparticles and their Application in Chemistry and Biomedicine

**Abstract:** Functionalized magnetic nanoparticles are proposed as smart platforms for applications in chemistry - emphasizing catalysis -, environmental chemistry - emphasizing catalytic detoxification, or biomedicine - emphasizing delivery of biomolecules and drugs. The magnetic properties of the entities offer an additional dimension for their manipulation by external magnetic fields, e.g. for flow reactors, for recovery from the environment, for imaging (MRI) or for directed targeting of tumors in living beings. The consortium spans the synthesis of coated (graphene, silica, polymers) magnetic nanoparticles with metal and metal oxides cores, covalent and non-covalent functionalization with chemical and biomedical agents, applications in homogeneous and heterogeneous catalysis for fine chemical production or detoxification of the environment, or biomedical applications such as tumor recognition, drug delivery or gene transfection. Disciplines involved are Chemistry, Biochemistry and Bioanalytical Chemistry, Chemical Engineering and Material Science, Physics, and Medicine.

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**NBR: 290251** **ACRONYM: NANOS3** **EC FUND: 3619626**

**DG:** REA **Call: FP7-PEOPLE-2011-ITN** **Thema:** FP7-PEOPLE-2011-ITN

**Title:** Soft, Small, and Smart: Design, Assembly, and Dynamics of Novel Nanoparticles for Novel Industrial Applications"

**Abstract:** The proposed ITN (NanoS3) have assembled eight academic groups with complementary expertise in synthesis, modeling and characterization. They are joined by two full industrial partners active in the development of novel luminescent materials (LuminoChem), and in the home and personal care sectors (Procter and Gamble). Two associated partners will contribute to the work of our proposed network: BioTalentum is an SME in the field of stem-cell research and the Institute for Surface Chemistry (YKI) is a world-leading research institute in applied surface chemistry. Our work will focus on three priority areas of research: • 1: Organizing Soft Nanoparticles • 2: Dynamics of Soft Nanoparticles • 3: Soft Nanoparticles at Interfaces These S&T objectives are combined

with the ambitious objectives to train and promote qualified research project managers in the field of soft matter nanoscience, capable to work in research or industry together with experts in different disciplines and in different countries. We will accomplish our goal by training early stage researchers in a wide variety of modern bulk and surface techniques, as well as in modelling and synthetic methods. We will organize a series of tutorial courses on specialized topics, organize network workshops, and implement secondments and visits. To develop the complementary skills needed to start a successful career either in academia or in R&D we will organize trainings in e.g. Project management, Proposal writing, Presentation skills, IP and patent rights and Innovation.

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**NBR: 290455** **ACRONYM: ECAMM** **EC FUND: 445000**

**DG:** RTD **Call: FP7-NMP-2011-CSA-5** **Thema:** NMP.2011.4.0-5

**Title:** European structured research area for CAtalytic and Magnetic nanoMaterials

**Abstract:** The objective of the proposal is to support the creation of a European structured research area for catalytic and magnetic nanomaterials by integrating two DISs (ERIC and EIMM) operating in the fields of catalysts and nanomagnetism, and their plan to expand current activities in order to (1) obtain a larger coverage of industrial technologies/sectors and (2) extend the involvement to the activities of the relevant industrial partners. The aim is to create a realistic basis to achieve financial sustainability of the two DISs which will keep their own individual personality, but share knowledge and expertise, structure, equipment and other resources, to offer a broader and cost-effective range of services to companies, and in the long-term the vision is to provide new competences (deriving from the integrated collaboration) to new industrial sectors such as materials for nanomedicine, health care and diagnostics, to ICT, environment protection, and nanomaterials' risk. Functional to this objective are also the possibilities a) to realize efficient synergies to reduce the management costs of the DISs, and to be more cost-effective for a structuring effect inside ERA, b) create a larger critical mass, and a broader spectrum of expertise and equipment, c) improve the attractiveness towards young researchers through a combination of high-profile science and educational activities in their favor, and d) enhance the visibility and develop more efficient politics for incorporating new partners in order to progressively expand the actual core partners. Reaching the objectives, implementing these activities will thus result in 1) an improved coordination in both research and innovation, through the management and cultural synergies between the two DISs (ERIC and EIMM); 2) a more robust critical mass of the durable integrated structure; 3) a boosted dynamism of research, technological development and innovation in the field(s); and 4) an improved structuring of the European Research Area.

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**NBR: 290467** **ACRONYM: ASTEX** **EC FUND: 2344390**

**DG:** ERCEA **Call: ERC-2011-ADG_20110209** **Thema:** ERC-AG-PE2

**Title:** Attosecond Science by Transmission and Emission of X-rays

**Abstract:** This is a programme of advanced research with potential for high scientific impact and applications to areas of great strategic importance such as renewable energy and biomolecular technology. The aim is to develop and apply a combination of cutting-edge tools to observe and understand dynamics in molecules and condensed phase matter with attosecond temporal and nanometre spatial resolutions. The programme, will exploit two new types of measurements that my group have already begun to develop: high harmonic generation (HHG) spectroscopy and attosecond absorption pump-probe spectroscopy, and will apply them to the measurement of attosecond electron dynamics in large molecules and the condensed phase. These methods rely upon the emission and transmission of soft X-ray attosecond fields that make accessible measurement not only of larger molecules in the gas phase but also thin (micron to nanometre) samples in the condensed phase. This is a research project that will open new frontiers both experimentally and theoretically. The challenge of this research is high and will be met by a concerted programme that is well matched to my teams experimental and theoretical expertise in attosecond physics, ultrafast intense-field science, soft X-ray techniques and advanced techniques for creating gaseous and condensed phase samples.

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**NBR: 290490** **ACRONYM: ECNP-GROWTH** **EC FUND: 444192**

**DG:** RTD **Call: FP7-NMP-2011-CSA-5** **Thema:** NMP.2011.4.0-5

**Title:** CONSOLIDATION OF THE EUROPEAN CENTRE FOR NANOSTRUCTURED POLYMERS

**Abstract:** This proposal addresses the consolidation of the European Centre for Nanostructured Polymers - ECNP - which was established in 2006 by the European Network of Excellence NANOFUN-POLY (FP6 2004-2008) and is currently operating in coordinating research, dissemination and technology transfer activities among its partners. ECNP is focused on the continuation of the four main activities of the NoE: a joint research road map, a joint educational programme, a joint infrastructure and joint technology transfer services in the specific field of multifunctional nanostructured polymers and nanocomposites. So, this support action intends to consolidate ECNP offering a realistic financial plan to expand the current activities by ensuring coverage of industrial technologies research and transfer relevant to the main application sectors addressed by ECNP: Manufacturing (Polymer Nanocomposites), Energy (Flexible Photovoltaics), Healthcare (Biomaterials), and ensuring the extended participation of relevant industrial partners. It is expected

that this support action will improve coordination in research and innovation on polymer nanotechnologies and will generate a more robust critical mass of the durable integrated structure of ECNP, leading to a better structuring of the European Research Area.

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**NBR: 290575** **ACRONYM: NANOPINION** **EC FUND: 2087600**

**DG:** RTD **Call: FP7-NMP-2011-CSA-5** **Thema:** NMP.2011.1.3-4

**Title:** Monitoring public opinion on Nanotechnology in Europe

**Abstract:** NANOPINION will provide a multi-tasking and enlivening online science-technology-social media-based platform for learning, information, outreach, dialogue and monitoring for young people, general public and consumer opinion on NT, realising the need for enhanced communication and dialogue between science and society for successful technology development and societal acceptance. A central dialogue arena of both physical and virtual aspects will be created to establish a dynamic outreach and dialogue model that will address the public in the high street via street knowledge and opinion labs, and other target groups in a variety of interactions in live events, online project portal, and web 2.0 tools. Controversial issues will be discussed on range of channels in order to establish a trustworthy and informed dialogue with the public. The engagements will be monitored continuously, and citizens opinions of NT will be gathered and traced using validated online and offline tools, thus providing clear direction and challenges driven by the citizens opinion regarding communication, NT fields, regulation, governance, research, social implications and education of NT. Past FP6/7 projects will be extensively used as prime knowledge, information and education resources for the project. NANOPINION will contribute to awareness and interest raising in the realm of NT, by engaging all age groups in the wider public in informing and discussion surrounding NT. We aim for the project to serve as an access bridge between FP7 and FP8 thus provides the EC with insights for policy framing concerning NT. The NANOPINION takes the debate to the outdoor arena dealing with “tough to reach” audience, that usually do not participate in science debates. Also, The project is going to offer experimental NT curriculum for high school that will carried out in EU, Associated countries and Russia. This curriculum will ne used for a future bacaloriate/ A level/ matriculation program of study NT.

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**NBR: 290589** **ACRONYM: ITS-NANO** **EC FUND: 724899**

**DG:** RTD **Call: FP7-NMP-2011-CSA-5** **Thema:** NMP.2011.1.3-3

**Title:** INTELLIGENT TESTING STRATEGY FOR ENGINEERED NANOMATERIALS"

**Abstract:** The background, concept and objectives of ITS-NANO are straight forward. The volume of information on hazard characterisation of ENM is increasing fast. In parallel with the scientific development, regulation orientated initiatives are also taking place to identify needs. The ITS-NANO concept is 1: Gather targeted all scientific evidence, by literature search and communication with leading scientists. 2: Develop an initial assessment (document) of the available knowledge and the gaps, focussed on identifying knowledge level as how to develop an intelligent approach to grouping ENMs based their properties and their subsequent biological impacts in order to intelligently design next-generation nanosafety evaluation and risk assessment strategies. 3: Assemble stakeholders for presenting the initial assessment, having a dialog on how this relates to their aims/needs and how to make a consent driven strategy forward that ensures communication. 4: Revise the initial assessment document with the input from the stakeholder sent around for commenting, presenting the next draft for a smaller group for final commenting. 5: Publish it.

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**NBR: 290861** **ACRONYM: PALEONANOLIFE** **EC FUND: 1468852**

**DG:** ERCEA **Call: ERC-2011-ADG_20110209** **Thema:** ERC-AG-PE10

**Title:** Responses of precambrian life to environmental changes

**Abstract:** This multidisciplinary proposal has the objective to enhance our knowledge on the early steps of the evolution of life on Earth by providing a foundation for better deciphering the molecular fossil record as well as the geochemical signals hidden in ancient rocks. Based on the multiscale and multitechnique study of morphologically preserved microorganisms fossilized within ancient siliceous nodules, I propose to chronologically reconcile the evolution of metabolisms of life forms during the Precambrian with the variation of (sea)water paleo-temperatures registered by the silica matrix in which the investigated organic microfossils are embedded. Spatially-resolved information on fossil organic constituent speciation and their structural relationships with the silica matrix will be obtained at the nanometer scale using a unique combination of spectroscopy and microscopy techniques, notably including STXM and TEM. Crucial information on paleo-metabolisms will be obtained from NanoSIMS experiments by measuring the stable H-C-N-S isotope composition of the investigated fossilized objects at the scale of individual cells. In parallel, laboratory experiments will be conducted to better assess the potential isotopic and molecular evolution of organic molecules during the fossilization process. Estimations of water paleo-temperatures – likely corresponding to oceanic paleo-temperatures – will be achieved based on the distribution of the silicon and oxygen isotopic composition of silica closely associated to the fossil cells, measured at the very high spatial resolution of the NanoSIMS. Furthermore, the study of natural proxies will provide a more profound understanding of the significance of the temperature

registered by the isotopic compositions of Precambrian cherts. In addition to radically change scientific ideas about Precambrian Paleontology, the technical and scientific developments resulting from this work will be broadly applicable and serve numerous communities.

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**NBR: 290981** **ACRONYM: PLASMONANOQUANTA** **EC FUND: 1347600**

**DG:** ERCEA **Call: ERC-2011-ADG_20110209** **Thema:** ERC-AG-PE3

**Title:** Frontiers in Plasmonics: Transformation Optics, Quantum and Non-linear phenomena

**Abstract:** The overall objective of this proposal is to work in depth along three ground-breaking lines of research that are at the cutting edge of the current research in Plasmonics. These three subjects have strong overlap and are: 1) Non-linear phenomena and Plasmonic lasing: the introduction of optical-gain media into plasmonic waveguides has proven to be a feasible way to overcome the inherent losses within the metal. In order to reveal the physics behind this phenomenon, we intend to develop a new ab-initio theoretical framework that should combine the resolution of classical Maxwell's equations with a quantum-mechanical treatment of the molecules forming the optical-gain medium. Within this formalism we also aim to analyze in depth very recent proposals of plasmon-based nano-lasers, the design of active devices based on surface plasmons and the use of optical-gain media in metallic metamaterials. 2) Transformation Optics for Plasmonics: we plan to apply the idea of Transformation Optics in connection with the concept of Metamaterials to devise new strategies for molding the propagation of surface plasmons in nanostructured metal surfaces. Additionally, we will use the Transformation Optics formalism to treat quasi-analytically non-local effects in plasmonic structures. 3) Quantum Plasmonics: several aspects of this new line of research will be tackled. Among others, fundamental studies of the coherence of surface plasmons that propagate along different metal waveguides after being generated by quantum emitters. A very promising line of research to explore will be plasmon-mediated interaction between qubits, taking advantage of the quasi-one-dimensional character of plasmonic waveguides. Strong-coupling phenomena between molecules and surface plasmons and the design of practical scenarios in which entanglement of surface plasmons could take place will be also addressed. We also plan to study how to generate surface plasmons with orbital angular momentum.

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**NBR: 290998** **ACRONYM: SMARTMET** **EC FUND: 2920000**

**DG:** ERCEA **Call: ERC-2011-ADG_20110209** **Thema:** ERC-AG-PE5

**Title:** Adaptive nanostructures in next generation metallic materials: Converting mechanically unstable structures into smart engineering alloys

**Abstract:** The design of advanced high strength and damage tolerant metallic materials for energy, mobility, and health applications forms the engineering and manufacturing backbone of Europe's industry. Examples are creep-resistant Ni-alloys in power plants and plane turbines; ultrahigh strength steels, Al- and Mg-alloys for light-weight mobility and aerospace design; or Ti-implants in aging societies. Since the Bronze Age the design of metallic alloys rooted in trial and error, owing to the complexity of the physical and chemical mechanisms involved and the engineering conditions imposed during manufacturing. This traditional approach has two shortcomings. First, current alloys are not developed via systematic design rules but via empirical methods. This approach is time consuming and inefficient. Second, the increase in strength via traditional hardening mechanisms always causes a dramatic decrease in ductility, i.e., making the material brittle and susceptible to failure. SMARTMET aims at solving this inverse strength-ductility problem: The joint use of advanced synthesis and atomic characterization (expertise of PI) together with ab initio modeling (expertise of Co-PI) opens a new path to the design of next generation metallic alloys. The objective is to use these methods to identify and utilize strengthening mechanisms that allow to overcome the inverse relationship between strength and ductility. The key idea is to incorporate phases into alloys that are close or beyond their mechanical and thermodynamic stability limit. They undergo transformations under load acting as self-organized repair mechanism. SMARTMET contains risks and gains: (i) Mechanical stability through unstable phases includes the risk of material weakening but it may break the inverse strength-ductility principle. (ii) New metallurgical alloys (PI) designed via quantum mechanics (Co-PI) is risky owing to the complexity of metallic nanostructures but allows alloy tailoring based on first principles.

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**NBR: 291002** **ACRONYM: SIZEFFECTS** **EC FUND: 2500000**

**DG:** ERCEA **Call: ERC-2011-ADG_20110209** **Thema:** ERC-AG-PE8

**Title:** Size effects in fracture and plasticity

**Abstract:** Understanding how materials respond to external mechanical perturbation is a central problem of science and engineering. While for most practical purposes it is useful to idealize the mechanical response of a material as a deterministic function of the externally applied perturbation, disorder and fluctuations are unavoidable, leading to sample-to-sample variations and non-trivial size effects. The size dependence of strength is a well known but still unresolved issue in the fracture of materials and structures. The difficulty in addressing this problem stems from the complex interplay between microstructual heterogeneity and long-range elastic interactions. Furthermore, in micro and nanoscale samples, the plastic yield strength displays size effects and strain

bursts, features that are not present in macroscopic samples where plasticity is a smooth process. Large fluctuations both in fracture processes and in microscale plasticity make the use of conventional continuum mechanics problematic and calls instead for a statistically based approach. These problems are becoming particularly important in the current miniaturization trend towards nanoscale devices, since the relative amplitude of fluctuations grows as the sample size is reduced. In this project, concepts and tools of statistical mechanics are used to address size effects and fluctuations in the irreversible deformation and failure of materials. The general objective is to provide a quantitative theory that can be used as base for setting reliable safety factors. The theory will be based on the renormalization group and will be guided and validated by large scale numerical simulations such as molecular dynamics, discrete dislocation dynamics and disordered network models. Finally, we will analyze experimental data present in the literature.

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**NBR: 291038** **ACRONYM: INTERFACE** **EC FUND: 2493000**

**DG:** ERCEA **Call: ERC-2011-ADG_20110209** **Thema:** ERC-AG-PE2

**Title:** Quantum Optical Interfaces for Atoms and Nano-electro-mechanical Systems

**Abstract:** Quantum interfaces capable of transferring quantum states and generating entanglement between fields and matter are set to play a growing role in the development of science and technology. Development of such interfaces has been a crucial component in quantum information processing and communication. In the past decade quantum interfaces between atoms and optical photons have been extensively explored by a number of leading groups. Quantum state transfer between light and atoms, such as quantum memory and quantum teleportation, entanglement of massive objects, as well as measurements and sensing beyond standard quantum limits have been demonstrated by the group of the PI. We propose to develop a robust, integrated and scalable atom-light interface and to incorporate it into a hybrid multi-facet quantum network with other relevant quantum systems, such as nano-mechanical oscillators and electronic circuits. Towards this ambitious goal we will develop room temperature atomic quantum memories in spin protecting micro-cells (mu-cells) and opto-mechanical and electromechanical strongly coupled systems. Interfacing atoms, electronic circuits and nano-mechanical oscillators we will perform ultrasensitive quantum limited field and force measurements and quantum teleportation of states across the range of these systems. In the fundamental sense, this research program will further broaden the horizons of quantum physics and quantum information processing by expanding it into new and unexplored macroscopic domains.

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**NBR: 291085** **ACRONYM: PHASENANOCRACKER** **EC FUND: 2496000**

**DG:** ERCEA **Call: ERC-2011-ADG_20110209** **Thema:** ERC-AG-PE8

**Title:** The Metallurgical Nutcracker: Probing at the Nanoscale the Structure and Properties of Hard Second Phases in Alloys and Composites

**Abstract:** Our ambition is to probe the strength of "second" phases in multiphase metal alloys and composites, meaning of hard particles added to strengthen a metal, or alternatively of brittle inclusions that weaken it. Such phases are ubiquitous in structural metals; yet not much is known of the microstructural features that govern their strength. The underlying hypothesis of this project is that defects that limit the strength of such hard second phases can be identified and then altered by processing. Motivations for this enquiry stem from our previous research on metal composites, coupled with the fact that modern methods of nanoscale mechanical characterization now make such a quest feasible. Operationally, we plan to apply and extend nanomechanical testing to probe the strength of micrometric, irregularly shaped, hard particles currently used to strengthen metals. We aim to test such particles whole, and also for their local internal properties. Testing will rely on focused ion beam machining and adapted mechanical nanoprobing. These techniques will be combined to probe, using nanoindentation and original testing procedures, local and global strength values for hard second phase particles. Materials systems to be investigated are: (i) ceramic particles for the reinforcement of metal composites; (ii) silicon in aluminium, (iii) cementite and MC carbides in steel. Defects limiting the strength of these hard brittle phases suggested by nanoscopic mechanical testing will be identified using in-depth microstructural characterization, by electron microscopy notably, of both virgin and tested particles. The data will be supplemented by mechanical testing of macroscopic samples containing the hard particles in question. Processing routes will be explored, towards identification of strategies by which the strength of such second phases can be improved to improve, in turn, the performance of several important engineering materials.

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**NBR: 291094** **ACRONYM: ELBM** **EC FUND: 1656800**

**DG:** ERCEA **Call: ERC-2011-ADG_20110209** **Thema:** ERC-AG-PE8

**Title:** Frontiers for multi-scale computational fluid dynamics

**Abstract:** Computational fluid dynamics remains challenged with the complexity of fluid motion on all scales from atmospheric phenomena down to flows in micro- and nano-devices. The lattice Boltzmann method (LBM) has been conceived to replace the conventional methods of computational fluid dynamics. Due to its computational efficiency and simplicity in handling complex geometries, LBM was only partly successful in simulating incompressible flows. However, it faced stiff challenges in other domains of fluid dynamics due to low isotropy of the lattice and lack of stability. Recently, a new

generation of entropic lattice Boltzmann models (ELBM) restored second law of thermodynamics in the lattice Boltzmann kinetics and made lattice Boltzmann unconditionally stable. Armed with new higher-order entropic lattices, ELBM project will open up high Reynolds number flows, compressible flows, multi-phase and micro flows and other domains for fast and efficient simulations. New ELBM models retain all the advantages of LBM in terms of efficiency, parallelism, and handling of complex geometries. This project will serve as unique source of largest possible benchmark simulations and engineering applications in fluid dynamics; thus challenging or even replacing the most advanced methods of computational fluid dynamics as well as particle methods in micro flows.

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**NBR: 291132** **ACRONYM: ULTIMATE CERAMICS** **EC FUND: 1933200**

**DG:** ERCEA **Call: ERC-2011-ADG_20110209** **Thema:** ERC-AG-PE8

**Title:** Printed Electroceramics with Ultimate Compositions

**Abstract:** The ultimate goal of this research is to make extremely advanced leap enabling processing of wide variety of ceramic materials at ultra low temperatures denoted as ULTIMATE CERAMICS(200-500 oC). The project has its risks, but advantages like utilization of pure ceramic materials on challenging substrates like plastic and paper could offer novel scientific results as well as business opportunities to European industry. Key issues based on scientific laws of matters forming the basic research methodology to succeed are • intelligent selection and development of starting materials • utilization of nano technology • management of dense and uniform packaging of powder particles • minimization of required activation energy during sintering • management of type, level and rate of diffusion in sintering • microwave sintering There are several reasons why this kind of ULTIMATE CERAMICS can now be seriously research. The main issues are that ano particle silver pastes sinterable at ~ 200 oC have recently become commercially available, and ceramics with nano particle size have been widely on the market. However, taking the high risk, ground-breaking challenge, ultimate novel materials and processes are available. ULTIMATE CERAMICS offer significance novel business opportunities for European industry not available in any other way since ceramic materials are able to perform e.g. as semiconductors, dielectric, non-linear dielectrics, sensors, and electrically or magnetically tunable devices. In the industrial point of view, the main issue is to enable printable structures on paper compatible with nano particle silver electrodes and printed organic materials. It is also obvious that novel scientific results will be created especially when several techniques like e.g. microwave sintering – nano particles – sintering aids –silver electrodes - are combined.

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**NBR: 291194** **ACRONYM: CEMAS** **EC FUND: 2496720**

**DG:** ERCEA **Call: ERC-2011-ADG_20110209** **Thema:** ERC-AG-PE3

**Title:** Controlling and Exploring Molecular Systems at the Atomic Scale with Atomic Force Microscopy

**Abstract:** The objective of this project is to advance and use Atomic Force Microscopy (AFM) to explore the physical and chemical properties of single molecules and molecular systems with unprecedented spatial resolution. We will use AFM to develop atomically resolved molecular imaging with structural and chemical identification and investigate charge distribution and transfer in molecular systems. The AFM will allow the extension of seminal Scanning Tunneling Microscopy (STM) work on atoms/molecules on ultra-thin insulating films to thick insulating films, to control and explore single molecule chemistry processes in utmost detail. The whole work will be significantly based on the development and exploitation of novel atomic and molecular manipulation processes to control matter at the atomic scale, both for fabricating novel complex molecular nanostructures with atomic scale precision and understanding these systems, as well as for probe-tip functionalization to tailor tip-substrate interaction. Instrumental enhancements will focus on fabricating novel AFM sensors for simultaneous lateral and vertical force measurement and on developing a new original approach to increase the time resolution in AFM measurements. Due to the fundamental nature of this work we expect the long term impact of this work to be in surface science, chemistry, molecular electronics and life sciences. In the short term we expect to develop the AFM into a practical tool for chemical structure determination of unknown molecules and we will employ atomic manipulation and high resolution AFM imaging to image, modify and functionalize graphene edge structures with atomic scale precision with the prospect of exploring and developing novel molecular devices.

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**NBR: 291211** **ACRONYM: STREAM** **EC FUND: 2407400**

**DG:** ERCEA **Call: ERC-2011-ADG_20110209** **Thema:** ERC-AG-PE5

**Title:** Structural evolution at the nano- and mesoscale

**Abstract:** This proposal aims to establish a novel type of kinetic experiment by combining microfluidics with micro-x-ray technology to develop a fundamental understanding of nucleation and growth of organic and inorganic nanoparticles, thus aiming to help producing these particles more efficiently in times of constraint materials resources. The methodology maps particle growth kinetics form the time- to the length scale. The proposed combination with microbeam x-ray diffraction extends the temporal resolution, determined by the spot-size of the microbeam, into the microsecond regime.

This enables to elucidate nanoparticle nucleation and growth from early nucleation states to late growth states during which the shape of the particles is decided, thus opening pathways to new particle morphologies and improving existing synthetic procedures. The method is applied to the investigation of amphiphile self-assembly kinetics, inorganic nanocrystal growth and ultrafast polymer nanoparticle formation, where any improvement in the understanding of the growth mechanism is expected to directly lead to a more rational design of the synthesis, extending the range of morphologies and applications. That way, it is expected that STREAM can clarify particle nucleation and growth to expand the possibilities of nanoparticle synthesis to provide new and better materials for energy, information and medical technology.

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**NBR: 291216** **ACRONYM: WIPFAB** **EC FUND: 3062006**

**DG:** ERCEA **Call: ERC-2011-ADG_20110209** **Thema:** ERC-AG-PE7

**Title:** Wideband Integrated Photonics For Accessible Biomedical Diagnostics

**Abstract:** Photonic technologies are set to revolutionise our access to chemical and biochemical information, driven by demand for fast, low-cost, automated chemical analysis in applications from food safety, water quality, security, personal and preventative medicine, pharmacogenetics to point-of-care diagnostics. The low cost and robustness of microfabrication approaches which enabled the mobile phone and digital camera are expected to lead to similarly widespread deployment of chemical and bioanalytical microsystems. Optical techniques play a major role in quantitative chemical analysis and are the mainstay of detection in “lab-on-chip” systems, but the degree of optical functionality integrated in these systems remains extremely limited, and they have yet to benefit fully from the recent massive growth in photonics communications technologies. Photonic technologies for telecommunications operate in the near infra-red (NIR) wavelength region from 800nm – 1800nm, driven by the spectral transmission window in silica optical fibre. However, the ideal molecular “fingerprint” region for biochemical analysis is dominated by the mid infra-red (MIR) spectral region. Biosensor and lab-on-chip research and commercialisation have both been severely hampered by the lack of an integrated photonic platform which can operate over both the NIR and MIR spectral ranges, and which would enable new opportunities for sensitive, selective, label-free biochemical analysis. This programme sets out to advance the frontiers of biophotonics research in MIR materials systems, integrated photonic components for biochemical analysis and nanostructured photonic materials for light control. New approaches to clinical point-of-care diagnostics will be enabled by realising a mass-manufacturable monolithically-integrated photonics/optofluidic technology for chemical and biochemical analysis in the near and mid-infrared, exploiting advanced spectroscopic techniques for accessible biomedical diagnostic

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**NBR: 291234** **ACRONYM: MICE** **EC FUND: 1583887**

**DG:** ERCEA **Call: ERC-2011-ADG_20110209** **Thema:** ERC-AG-PE3

**Title:** Microflow in Complex Environments

**Abstract:** We will study the way in which the hydrodynamics of simple, complex and active fluids is affected by their environment, in particular by patterned surfaces and by confinement. We shall concentrate on micron and nanometric length scales where surfaces are often key in controlling fluid behaviour. The work is driven by current rapid and exciting advances in fabricating micropatterned substrates and by new experimental techniques probing the flow properties of fluids at these scales. Our work will be primarily computational and theoretical, but with an experimental component within Oxford, and with close experimental links to several groups internationally. The systems we will concentrate on are: 1. simple fluids at micropatterned substrates: We aim to understand interface pinning, particularly on anisotropic surfaces, and superhydrophobic hydrodynamics. The knowledge will be used to help design devices, such as displays and condensers that exploit fluid-surface interactions at the mesoscale. 2. complex fluids in confinement and at patterned substrates: We shall concentrate on the f-d virus as a highly monodisperse system of colloidal rods which shows lyotropic liquid crystalline ordering. A close collaboration between experiment and simulation will investigate the interplay between elasticity, surface anchoring, flow, topological defects and interface instabilities. 3. active fluids at surfaces: Our aim is to understand low Reynolds number swimming in the vicinity of rough surfaces and in confined systems such as microchannels and fluid drops. Microswimmers provide an experimentally and theoretically accessible example of non-equilibrium statistical physics and have a range of striking behaviours, including clustering, low Reynolds number turbulence and anomalous flow field statistics, that remain exciting challenges.

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**NBR: 291239** **ACRONYM: MASTER** **EC FUND: 2496000**

**DG:** ERCEA **Call: ERC-2011-ADG_20110209** **Thema:** ERC-AG-PE8

**Title:** Mastering the Computational Challenges in Numerical Modeling and Optimum Design of CNT Reinforced Composites

**Abstract:** The innovative and challenging objective of the MASTER project is the numerical modeling and optimum design of complex carbon nanotube (CNT)-reinforced composite morphologies, via a novel and computationally efficient molecular mechanics-based, multiscale stochastic numerical simulation approach, in conjunction with a robust optimization methodology. The rationale of the project is to propose a generic approach for an accurate numerical modeling, efficient analysis and robust design considering

uncertainties, of high performance CNT-reinforced composites, in terms of mechanical and damping properties, which could have far reaching implications in the design of current as well as future nano-scale reinforced composites. The above undertaking is confronted with the excessive computational effort required to achieve the proposed objective. This computational effort will be mastered with highly efficient multiscale simulation approaches, innovative numerical solution methods, metaheuristic optimization algorithms, soft computing tools and the exploitation of the recent advances in high performance computing technology. The project has a multidisciplinary dimension by combining various scientific fields such as: molecular mechanics; continuum mechanics; stochastic mechanics; optimization; numerical analysis; soft computing; nanotechnology; material science and computer technology. The achievements of this project are expected to significantly enhance our knowledge on the analysis and design of nanocomposites beyond the current state of the art.

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**NBR: 291260** **ACRONYM: SMARTGATE** **EC FUND: 1221611**

**DG:** ERCEA **Call: ERC-2011-ADG_20110209** **Thema:** ERC-AG-PE7

**Title:** Smart Gates for the "Green" Transistor

**Abstract:** Ultra-low voltage/power operation is expected to be an important requirement for future nanoelectronics allowing more dense and fast circuits on one hand and enabling the operation of energy efficient intelligent autonomous systems on the other. In present day devices quite a lot of power is consumed during switching since it requires a minimum bias of 60 mV on the gate to overcome a potential barrier and increase the transistor current by a decade, a process which is fundamentally limited by thermal Boltzmann statistics. We propose the development of novel negative capacitance “smart” gates with a positive feedback and internal amplification to overcome the “Boltzmann tyranny” and obtain steeper slope “green” transistors capable of operating at very low voltage. Metallic systems with a low density of states could provide the required dominant negative contributions to the capacitance due to strong carrier correlation effects. Such metallic systems made of 2D Dirac fermions with linear dispersion bands are supported in graphene and on the surface of the newly discovered topological insulators having the very interesting property that they offer a nearly zero density of states at the band crossing near the charge neutral point. We propose here the graphene and Bi2Se3-based topological insulators as the key components of the targeted “smart” gates. We aim at developing complex gate structures facing the challenges of growth of high purity and high crystalline quality graphene and Bi2Se3 thin films in combination with conventional dielectrics and metals on Si semiconductor in an effort to obtain the required properties and ensure their robust functionality at room temperature. Possible negative capacitance effects will be investigated in terms of generic capacitor electrical characterization, while transistor devices with optimum smart gates will be fabricated to prove the principle of steep slope switching.

**NBR: 291319** **ACRONYM: AFTERTHEGOLDRUSH** **EC FUND: 2279785**

**DG:** ERCEA **Call: ERC-2011-ADG_20110209** **Thema:** ERC-AG-PE4

**Title:** Addressing global sustainability challenges by changing perceptions in catalyst design

**Abstract:** One of the greatest challenges facing society is the sustainability of resources. At present, a step change in the sustainable use of resources is needed and catalysis lies at the heart of the solution by providing new routes to carbon dioxide mitigation, energy security and water conservation. It is clear that new high efficiency game-changing catalysts are required to meet the challenge. This proposal will focus on excellence in catalyst design by learning from recent step change advances in gold catalysis by challenging perceptions. Intense interest in gold catalysts over the past two decades has accelerated our understanding of gold particle-size effects, gold-support and gold-metal interactions, the interchange between atomic and ionic gold species, and the role of the gold-support interface in creating and maintaining catalytic activity. The field has also driven the development of cutting-edge techniques, particularly in microscopy and transient kinetics, providing detailed structural characterisation on the nano-scale and probing the short-range and often short-lived interactions. By comparison, our understanding of other metal catalysts has remained relatively static. The proposed programme will engender a step change in the design of supported-metal catalysts, by exploiting the learning and the techniques emerging from gold catalysis. The research will be set out in two themes. In Theme 1 two established key grand challenges will be attacked; namely, energy vectors and greenhouse gas control. Theme 2 will address two new and emerging grand challenges in catalysis namely the effective low temperature activation of primary carbon hydrogen bonds and CO2 utilisation where instead of treating CO2 as a thermodynamic endpoint, the aim will be to re-use it as a feedstock for bulk chemical and fuel production. The legacy of the research will be the development of a new catalyst design approach that will provide a tool box for future catalyst development.

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**NBR: 291321** **ACRONYM: D-TXM** **EC FUND: 2499860**

**DG:** ERCEA **Call: ERC-2011-ADG_20110209** **Thema:** ERC-AG-PE5

**Title:** Diffraction Based Transmission X-ray Microscopy

**Abstract:** The aim of this project is to develop a diffraction based transmission X-ray microscope, d-TXM, for non-destructive structural characterization of polycrystalline materials such as metals, ceramics, semiconductors, dust, soil and rocks, and for R&D applications in

e.g. the energy-, electronics- and environmental sectors. Uniquely, d-TXM will be able to visualise the grains inside 100 micrometer thick specimens with a spatial resolution of 10-30 nm. Up to a thousand grains may be mapped simultaneously in three dimensions with respect to morphology, phase, orientation and local stress-state. Furthermore, the method will be sufficiently fast to enable the acquisition of 3D movies of the time evolution of the structure in nano-materials and components during synthesis, processing or operation. During the last decade the applicant pioneered and matured a set of X-ray based methods for 3D studies of polycrystals on the micrometre scale. For this achievement, he is recognized as a worldwide leading figure in X-ray instrumentation for structural materials, situated at a nodal point between materials, X-ray physics, applied mathematics and crystallography. The underlying vision of d-TXM is similar to this past work, but in terms of optics the microscopy approach is radically different and the spatial resolution will be two orders of magnitude better. In this project, the scientific potential will be demonstrated by means of applications to selected issues in metallurgy. Being able to directly observe the evolution of the individual crystalline elements, our understanding of processes such as plasticity and phase evolution can be greatly enhanced. Dissemination to other fields will take place via an advisory board of future users and a workshop. Continuity of the project is ensured by the technique being implemented at the European Synchrotron Research Facility.

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**NBR: 291349** **ACRONYM: PHOTBOTS** **EC FUND: 2200000**

**DG:** ERCEA **Call: ERC-2011-ADG_20110209** **Thema:** ERC-AG-PE2

**Title:** Nano Photonics-Based Micro Robotics

**Abstract:** The general goal is to bring together different fields of research in order to create a new research area of photonic micro robotics. That is to create, study, and implement truly microscopic structures with nano scale accuracy that can perform robotic tasks and that are entirely powered and controlled by light. This idea brings immense challenges both from the point of view of the physics involved as well as the chemistry needed to create the appropriate materials, but if successful can also have a huge impact. To achieve this, we will combine our expertise on complex photonic materials and direct laser writing, to create micro structured patterns in liquid crystal elastomers, which are rubber-like polymers with liquid crystalline properties that can be triggered with light. In our view, this opens up a new strategy to create robots of various kinds, on a truly micrometer length scale. That is, micro robots that can swim, walk, or crawl, and when at destination perform specific tasks, controlled and driven by light. This proposal, in the first instance, deals with fundamental, curiosity-driven research and wishes to address the wealth of physics and chemistry that arises when combining nano photonics with micro robotics. Having said that, the range of potential applications is very broad. Our photonic micro robots would be able to penetrate otherwise difficult to access environments and

perform tasks such as sensing or sampling. They could be made in large quantities which means they could also be put into action collectively in swarms (using mechanical and/or optical interaction between the individual robots). The project is truly interdisciplinary, which makes it very challenging but also exciting. The photonic micro robotic structures will be created by bringing together concepts from physics and chemistry, while the inspiration for designs comes partly from biology and potential applications can be foreseen in medicine.

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**NBR: 291364** **ACRONYM: MIMEFUN** **EC FUND: 2296320**

**DG:** ERCEA **Call: ERC-2011-ADG_20110209** **Thema:** ERC-AG-PE5

**Title:** Biomimetics for Functions and Responses

**Abstract:** Energy efficiency and sustainability encourage to develop lightweight materials with excellent mechanical properties, combining also additional functionalities and responses. Therein nature allows inspiration, as e.g. pearl of nacre and silk show extraordinary mechanical properties due to their aligned self-assemblies. However, biological complexity poses great challenges and in biomimetics selected features are mimicked using simpler concepts. Previously artificial nacre has been mimicked by multilayer and sequential techniques and ice-templating. However, concepts for aligned spontaneous self-assemblies are called for scalability. We will develop toughened nacre-inspired materials by templating functionalized polymers on colloidal sheets in suspension, followed by self-assembly by solvent removal. Similarly, we will develop silk-mimetic materials using aligned organic fibrous reinforcements in soft dissipative matrix. Nanofibrillated cellulose will be wet-spun using extrusion into coagulant bath, followed by post drawing, drying and functionalization to allow silk-like fibers with high mechanical properties. In another route, cellulose rod-like whiskers will be decorated with soft functional polymers allowing energy dissipation, followed by alignment and interlinking to mimick silk-assemblies. The colloidal routes allow also new functionalities by using functional polymers, e.g. electroactive and conjugated polymers and nanoparticles. Importantly, redox-active polymers are bound on the colloidal sheets. Incorporating in a planar electrochemical cell with flexible electrodes, electrochemical switching of stiffness is obtained using a small voltage, as the intercolloidal interaction is controlled by the charge state of the redox-active layers. This would allow a new class of material, eg. to interface users and devices. In summary, we present a colloidal self-assembly platform for biomimetic materials with exciting mechanical, functional, and switching properties.

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**NBR: 291371** **ACRONYM: LCC** **EC FUND: 1738432**

**DG:** ERCEA **Call: ERC-2011-ADG_20110209** **Thema:** ERC-AG-PE4

**Title:** Coupled Cluster Calculations on Large Molecular Systems

**Abstract:** Quantum mechanics provides the key to the understanding of the molecular world. Many years of theoretical research have made coupled cluster calculations the state-of-the-art method for small molecules, where calculations have reached an accuracy often challenging experimental results. To describe large molecular systems with coupled cluster methods, the computational scaling with the system size of existing methods represents a roadblock to progress. The ultimate goal is to obtain coupled cluster methods that scale linearly with system size and where the calculations are embarrassingly parallel, such that calculations for small and large molecular systems require the same computational wall time. This proposal describes how this goal may be accomplished. The key is to express the coupled cluster wave function in a basis of local Hartree-Fock (HF) orbitals. We have recently shown how such a local HF basis may be obtained and described how linear-scaling, embarrassingly parallel coupled cluster energies may be obtained. Here we present proof-of-concept calculations for the energy and the molecular gradient for the simple model MP2 (second order Møller-Plesset perturbation theory) and propose to use the same technology for higher level coupled cluster methods to yield not only the energy of a large molecule, but also molecular properties as the equilibrium geometry, harmonic frequencies, excitation energies and transition moments, nuclear shieldings, polarizabilities and electronic and vibrational circular dichroism. This proposal will open a new era of accurate quantum calculations on large molecular systems such as nanoparticles and proteins. The presented developments will accelerate research, not only in chemistry and physics, but in molecular science and engineering in general.

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**NBR: 291474** **ACRONYM: QUEST** **EC FUND: 1999350**

**DG:** ERCEA **Call: ERC-2011-ADG_20110209** **Thema:** ERC-AG-PE3

**Title:** Quantum Entanglement in Electronic Solid State Devices

**Abstract:** The quantum world is by far larger than the classical one. It is entanglement, closely linked to non-locality, that spans this larger space manifold. Entanglement plays a central role in emerging quantum technology aiming to harvest quantum space. From the experimentalist's point of view working in nanoelectronics, there is no instrument on the shelf yet, that would measure the degree of entanglement. This we would like to change with QUEST. QUEST is a long term project with the goal to experimentally establish a continuous probe of entanglement generation in the electrical signal of quantum devices. It is set up in two parts: the realization of a highly efficient source of spin-entangled electron pairs and the exploration of different correlation measurements providing a measure of entanglement "on the fly". During the last decade a wealth of

theory proposals have appeared, addressing entanglement in electronic devices. The interaction of particles in solid-state devices provides a natural force for the appearance of entanglement. Examples are correlation between electrons and holes in the emission on a tunnel junction, or the “naturally” occurring Cooper pairs in s-wave superconductors. While first results on the realization of sources of entangled electron pairs have appeared recently, there are no experiments demonstrating entanglement in transport of any of those devices. We aim to change this and propose to implement high-bandwidth current correlation methods up to the forth moment, enabling to test Bell-inequality and quantum state tomo-graphy. Based on our long standing experience in the measurement of second-order correlations in nanodevices, we are well prepared for this very challenging goal.

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**NBR: 291482** **ACRONYM: INTERSOLAR** **EC FUND: 1800000**

**DG:** ERCEA **Call: ERC-2011-ADG_20110209** **Thema:** ERC-AG-PE5

**Title:** Rectifying interfaces for solar driven fuel synthesis

**Abstract:** There is rapidly growing interest in the science required to enable the conversion of solar energy into molecular fuels, motivated both by the need to develop a renewable, globally scalable transportation fuel strategy and the need to address the intermittency limitations of solar electrical power generation. Rapid progress is being made in the fabrication of inorganic, low cost, nanostructured photoelectrodes which utilise visible irradiation for such fuel syntheses, including water photolysis and CO2 photoreduction. However the efficiency of low cost photoelectrodes remains modest, due significantly to electron / hole recombination in the photoelectrode competing effectively with interfacial photochemistry. I propose to address this limitation by the use of multilayer interfaces designed to achieve enhanced uni-directional (i.e.: rectifying) charge separation, building directly from the extensive lessons I have learnt from my studies addressing an analogous challenge in dye sensitized solar cells. A key focus will be on the functionalisation of photoelectrodes with molecular and/or inorganic multi-electron catalysts to enhance the specificity and efficiency of the photoelectrode for fuel synthesis, exploiting recent, rapid advances in the syntheses of such catalysts. The use of rectifying interfaces is essential for the encorporation of such catalysts onto photoelectrodes, enabling the accumulation of multiple oxidations on the catalyst without this accumulation resulting in enhanced recombination losses. The proposal will undertake the assembly of such multilayer photoelectrodes, utlilising state of the art photoelectrode and catalyst materials, and the functional characterisation of these photoelectrodes, including measurement of interfacial electron transfer dynamics, with the aim of developing materials design rules which will enable systematic optimisation of photoelectrode function for efficient solar driven fuel synthesis.

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**NBR: 291522** **ACRONYM: 3DIMAGE** **EC FUND: 2337330**

**DG:** ERCEA **Call: ERC-2011-ADG_20110209** **Thema:** ERC-AG-PE4

**Title:** 3D Imaging Across Lengthscales: From Atoms to Grains

**Abstract:** Understanding structure-property relationships across lengthscales is key to the design of functional and structural materials and devices. Moreover, the complexity of modern devices extends to three dimensions and as such 3D characterization is required across those lengthscales to provide a complete understanding and enable improvement in the material's physical and chemical behaviour. 3D imaging and analysis from the atomic scale through to granular microstructure is proposed through the development of electron tomography using (S)TEM, and 'dual beam' SEM-FIB, techniques offering complementary approaches to 3D imaging across lengthscales stretching over 5 orders of magnitude. We propose to extend tomography to include novel methods to determine atom positions in 3D with approaches incorporating new reconstruction algorithms, image processing and complementary nano-diffraction techniques. At the nanoscale, true 3D nano-metrology of morphology and composition is a key objective of the project, minimizing reconstruction and visualization artefacts. Mapping strain and optical properties in 3D are ambitious and exciting challenges that will yield new information at the nanoscale. Using the SEM-FIB, 3D 'mesoscale' structures will be revealed: morphology, crystallography and composition can be mapped simultaneously, with ~5nm resolution and over volumes too large to tackle by (S)TEM and too small for most x-ray techniques. In parallel, we will apply 3D imaging to a wide variety of key materials including heterogeneous catalysts, aerospace alloys, biomaterials, photovoltaic materials, and novel semiconductors. We will collaborate with many departments in Cambridge and institutes worldwide. The personnel on the proposal will cover all aspects of the tomography proposed using high-end TEMs, including an aberration-corrected Titan, and a Helios dual beam. Importantly, a postdoc is dedicated to developing new algorithms for reconstruction, image and spectral processing.

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**NBR: 291543** **ACRONYM: IONACES** **EC FUND: 1494050**

**DG:** ERCEA **Call: ERC-2011-ADG_20110209** **Thema:** ERC-AG-PE5

**Title:** Understanding ion transport in nanoporous carbons

**Abstract:** Electrochemical Double-Layer Capacitors Electrochemical Capacitors (EDLC) are promising devices for clean energy storage applications. In EDLCs, the charges are stored electrostatically at the electrolyte / electrode interface, which confers them high power and cycling capabilities. Until recently, it was believed that charge storage in porous carbon EDLC electrodes could be achieved only if the pore size of the carbon was larger

than the electrolyte ions with their solvation shells. Using Carbides Derived Carbons (CDCs) which have controlled pore sizes between 0.6 nm and 1.1 nm, we recently demonstrated that high capacitive performances could be obtained when the pore size is smaller than the solvated ion size. The origin of this capacitance increase is still unclear despite important modelling efforts achieved by many research groups. Using our fine-tuned, controlled pore size CDCs carbons with narrow pore size distribution, we propose here an integrated approach combining the use of experimental electrochemical methods (EQCM, EIS, CV…) and in-situ analytical techniques (NMR, XRD), to computational modelling (Molecular Dynamics, Monte Carlo and Reverse Monte Carlo methods) to elucidate the ion transport and adsorption mechanisms inside nanopores. A direct application of this fundamental approach concerns the energy storage with supercapacitors. Thanks to the unique features offered by the CDCs, we propose to develop the next generation of high-energy density micro-supercapacitors from bulk CDC films. The evidence of the increase of the capacitive ion adsorption associated with ion partial desolvation in micropores is also of great interest in different areas such as water desalination. CDCs, which have demonstrated volumetric capacitance improvement of 100% compared to activated carbon for supercapacitor application, are appealing materials for water desalination applications, which will be the last part of the project.

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**NBR: 291593** **ACRONYM: FLUOROCODE** **EC FUND: 2423160**

**DG:** ERCEA **Call: ERC-2011-ADG_20110209** **Thema:** ERC-AG-PE4

**Title:** FLUOROCODE: a super-resolution optical map of DNA

**Abstract:** There has been an immense investment of time, effort and resources in the development of the technologies that enable DNA sequencing in the past 10 years. Despite the significant advances made, all of the current genomic sequencing technologies suffer from two important shortcomings. Firstly, sample preparation is time-consuming and expensive, and requiring a full day for sample preparation for next-generation sequencing experiments. Secondly, sequence information is delivered in short fragments, which are then assembled into a complete genome. Assembly is time-consuming and often results in a highly fragmented genomic sequence and the loss of important information on large-scale structural variation within the genome. We recently developed a super-resolution DNA mapping technology, which allows us to uniquely study genetic-scale features in genomic length DNA molecules. Labelling the DNA with fluorescent molecules at specific sequences and using high-resolution fluorescence microscopy enabled us to produce a map of a genomic DNA sequence with unparalleled resolution, the so called FLUOROCODE. In this project we aim to extend our methodology to map longer DNA molecules and to include a multi-colour version of the FLUOROCODE that will allow us to read genomic DNA molecules like a barcode and probe DNA methylation status. The sample preparation, DNA labelling and deposition

for imaging will be integrated to allow rapid mapping of DNA molecules. At the same time nanopores will be explored as a route to high-throughput DNA mapping. FLUOROCODE will develop technology that aims to complement the information derived from current DNA sequencing platforms. The technology developed by FLUOROCODE will enable DNA mapping at unprecedented speed and for a fraction of the cost of a typical DNA sequencing project. We aniticipate that our method will find applications in the rapid identification of pathogens and in producing genomic scaffolds to improve genome sequence assembly.

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**NBR: 291602** **ACRONYM: XLASERS** **EC FUND: 2500000**

**DG:** ERCEA **Call: ERC-2011-ADG_20110209** **Thema:** ERC-AG-PE3

**Title:** X-RAY LASERS, PHOTON SCIENCE, AND STRUCTURAL BIOLOGY

**Abstract:** Theory predicts that with an ultra-short and very bright coherent X-ray pulse, a single diffraction pattern may be recorded from a large macromolecule, a virus, or a cell before the sample explodes and turns into a plasma. The over-sampled diffraction pattern permits phase retrieval and hence structure determination. The first free-electron lasers (FELs) capable to deliver ultra bright and very short X-ray pulses for such experiments have recently started operations. These are the most brilliant sources of X-rays to date, exceeding the peak brilliance of conventional synchrotrons by a factor of 10 billion. In the duration of a single flash, the beam focused to a micron-sized spot has the same power density as all the sunlight hitting the Earth, focused to a millimetre square. The interaction of an intense X-ray pulse with matter is profoundly different from that of an optical pulse. A necessary goal of the programme is to explore photon-material interactions in strong X-ray fields. Our aim in structural biology is to step beyond conventional damage limits and develop the science and technology required to enable high-resolution studies of single biological objects near the physical limits of imaging. Eligible targets include single virus particles, organelles, cells, nanocrystals, and isolated macromolecules. A particular aim of the planned work is to obtain high-resolution structures for giant viruses. The challenges engage an interdisciplinary approach, drawing upon structural sciences, biology, atomic and plasma physics, optics and mathematics. The potential for breakthrough science is great with impact not only in biology or physics but wherever dynamic structural information with high spatial and temporal resolution is valuable. The overall relevance of the programme extends beyond basic science, to technologies of essential importance to a future Europe.

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**NBR: 291667** **ACRONYM: HIERARSACOL** **EC FUND: 2494334**

**DG:** ERCEA **Call: ERC-2011-ADG_20110209** **Thema:** ERC-AG-PE5

**Title:** Hierarchical Self Assembly of Colloids: Control and Manipulation from Nano-Granular

**Abstract:** Goal: to significantly extend our ability to manipulate the Self Assembly (SA) of colloidal nanoparticles (NPs) into complex 1D/2D/3D architectures (regular clusters, (composite)strings/rods, sheets, submicron colloidal crystals/liquid crystal phases of the NPs) over multiple length scales going from nano to that of granular matter. In the nano-regime quantum size effects cause materials properties to become strongly size dependent and thus highly tunable. Moreover, the synthesis of many NPs (metals, semiconductors, magnetic materials) is advanced enough that they can be made to crystallize into regular 3D lattices with new exciting functionality caused by collective effects. By performing SA in several independent stages, materials properties can be further tailored in new ways because of both access to different length scales and different NP combinations. In order to make systematic progress we will determine inter-NP potentials using 3D imaging. Both using subdiffractive confocal microscopy and cryogenic tomographic transmission electron microscopy. We will also use external fields (optical tweezers, electric/magnetic fields, shear) both to realize the complex architectures, but also to change particle properties dynamically. E.g., in monodisperse droplets of nematic phases of luminescent rodlike NPs an electric field can dramatically affect the scattering and emission of individual droplets. The droplets can subsequently be ordered in strings, sheets or crystals. Repeating the SA again delivers supra structures on the granular scale to tune e.g. heat or reagent flows. These projects combined will not only deliver new fundamental knowledge on SA, but the results are also expected to be directly useful for realizing applications based on the new meta-materials realized such as in displays, lighting, (optical) storage, (bio)sensing, catalysis, spintronics, photonic crystals, and the opto-electronics field in general.

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**NBR: 291803** **ACRONYM: AMAROUT-II** **EC FUND: 5054708**

**DG:** REA **Call: FP7-PEOPLE-2011-COFUND** **Thema:** FP7-PEOPLE-2011-COFUND

**Title:** AMAROUT-II EUROPE

**Abstract:** AMAROUT-II is a fellowship programme designed to support transnational mobility (incoming and reintegration) of experienced researchers, to give them the opportunity to deepen and widen their skills and to provide them with attractive working conditions. Specifically, over 4 years, AMAROUT-II will offer 152 fellowships to experienced researchers to develop their individual research projects within the IMDEA network. The IMDEA network is a network of international research centres promoted by the Madrid Regional Government with the goal of turning Madrid into one of the top knowledge generation regions in Europe. It is comprised of a number of specialised, independent research centres, each of them working in a scientific area of high potential economic

impact, namely: Water, Food, Social Sciences, Energy, Materials, Nanoscience, Networks, and Software. AMAROUT-II will significantly increase the number of transnational fellowships awarded by IMDEA to experienced researchers. AMAROUT-II is a continuation of AMAROUT, a highly successful COFUND programme. The increase in the number of fellowships in AMAROUT-II with respect to AMAROUT reflects (i) the increase in financial, physical, and human resources available within the IMDEA network, and (ii) the success of the AMAROUT programme in attracting top-level researchers to Madrid. Under no circumstances will AMAROUT fellows be considered elegible for AMAROUT-II fellowships. In conclusion, AMAROUT-II is a fellowship programme that will contribute to the further development and consolidation of the European Research Area (ERA), in alignment with the overall strategy PEOPLE programme, by stimulating people to take up the profession of researcher, by encouraging European researchers to stay in Europe, and by attracting to Europe, and in particular, to the Madrid region, the best researchers from around the world.

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**NBR: 291812** **ACRONYM: SAF€RA** **EC FUND: 1494988**

**DG:** RTD **Call: FP7-ERANET-2011-RTD** **Thema:** NMP.2011.4.0-7

**Title:** Coordination of European Research on Industrial Safety towards Smart and Sustainable Growth

**Abstract:** Industrial safety is an enabling and important success-factor in the pursuit of beneficial business activities. For this reason, industrial safety is a vital and important prerequisite for sustainable growth and competitiveness of the EU. Therefore, there is an urgent need to refocus the resources of national research programmes in EU Member States on industrial safety since the problems related to industrial safety are common to all and cannot be tackled adequately at the national level. SAF€RA will bring dynamism into European research on industrial safety by fostering collaboration of national research programmes, by encouraging lateral thinking and by promoting innovations related to implementation of industrial safety. The Consortium consists of 19 leading public agencies, ministries and research organizations funding or managing safety research working in close collaboration with stakeholders from industry, enterprises, authorities, science, social partners and society at large. The strategic objective of the SAF€RA project is to create a research and innovation market through systematic exchange of information and a stepwise integration of national research programmes in the EU by creating effective instruments which will emphasize collaboration between national research programmes on industrial safety. The goal is thus to promote the incorporation of a more effective safety culture into EU industrial activities to improve the competitive edge of European industries on a global scale. The scope of the SAF€RA will be to support traditional industries to solve existing safety challenges and to promote innovative novel industries, such as bio- and nanotechnology-based industries, to consider safety issues in all their activities from the outset. The SAF€RA therefore aims

at improving the safety of European industries to promote sustainable growth as well as sharpening their competitive edge.

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**NBR: 293538** **ACRONYM: FLEXSENS** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** FlexSens: Chemical Sensors for the 21st Century

**Abstract:** FlexSens aims to develop extremely versatile sensing strategies that can be used for the widespread generation of chemical information. The flexibility of the platform, then, refers to its ability to adapt to different environments, conditions and users. The work intends to bridge the gap between current technological developments in areas such as flexible electronics, smart textiles, wireless sensing networks, etc., and recent progress in sensors for analytical chemistry. Under guiding principles of a minimized human intervention, widespread availability and reduced costs, FlexSens will create autonomous or extremely simple tools to perform routine determinations that will not require direct intervention of an expert. Two main research lines will be explored: 1) Life embedded objects 2) Low cost disposable sensors. In the first one, the project will explore the incorporation of sensors in objects used in our everyday life, especially textiles. In the second one, extremely cheap, disposable paper printed sensors will be generated. The enabling technology will be a combination of recent progress in carbon nanotubes potentiometric sensing and printed electronics using carbon nanotubes inks. The end goal of FlexSens is to provide a battery of analytical approaches that can converge with existing and emerging social and technological trends to help in the solution of urgent social needs in many diverse areas, such as healthcare, environmental analysis, food production, etc. Carbon nanotubes will be immobilized in different surfaces -paper, cotton, rubbers- and properly functinoalized to create electrodes to be used in a potentiometric sensing scheme. The ways to generate the working and reference electrodes, their incorporation into everyday life objects and their final assessment in real life applications will be aim of this work.

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**NBR: 293567** **ACRONYM: SOLAR-PLUS** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** Maximizing the Efficiency of Luminescent Solar Concentrators by Implanting Resonant Plasmonic Nanostructures (SOLAR-PLUS)

**Abstract:** Maximizing the Efficiency of Luminescent SOLAR Concentrators by Implanting Resonant PLASmonic Nanostructures(SOLAR-PLUS) is a four-year interdisciplinary research project

in optical electromagnetic modeling, material engineering and nanotechnology fabrication, whose aim is to reduce the cost of harvesting solar energy by exploiting advanced nanophotonic concepts. The main technical objective of the proposed work is to double the energy conversion efficiency of a typical monolayer luminescent solar concentrator (LSC) system, currently standing at8%, by harnessing the interplay phenomena between fluorescence and localized surface Plasmon resonances. The deliverables of the project are: i) To understand the fundamental interactions between plasmonics and fluorescent molecules and through the gained physical insight to derive a set of design rules for metallic nanoparticles tailored to LSC applications, ii) to develop a generic simulation platform that combines nanoscale and macroscale modeling, to allow for rapid prototype performance assessment before proceeding to expensive fabrication, iii) to fabricate highly efficient prototype plasmonic-LSCs and, iv) to explore completely new research avenues that can bring about radical improvements to LSC efficiency. Improving the energy conversion efficiency of LSCs and reducing their cost are important steps towards the commercial viability of this technology, which will assist in the EUs efforts to limit its dependence on fosil fuels. In addition, the project will serve to ensure the long term professional stability of the fellow by assisting him in securing a permanent position in the department of Electrical and Electronic Engineering at University College London.

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**NBR: 293569** **ACRONYM: META-PHOT** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** Light-Matter Interaction in Smart Optical Materials

**Abstract:** It is well accepted that the future progress in many areas such as optical telecommunications, nonlinear optics, optical imaging, and light emission devices will sensitively rely on the availability of novel and/or strongly improved optical materials. Metamaterials have recently opened an exciting gateway to reach unprecedented physical properties and functionality unattainable from naturally existing materials. The artificial “atoms” and “molecules” in metamaterials can be tailored in shape and size, the lattice constant and inter-atomic interaction can be precisely tuned, and “defects” can be designed and placed at desired locations. The recent demonstration of negative refraction in bulk optical left-handed metamaterials is only one excellent example of new exciting physics arising from these materials. Yet such demonstrations are only the tips of the iceberg of what might possible with artificially engineered optical materials. This project sets to explore the revolutionary physics of optical metamaterials, covering nonlinear optical phenomena and wave dispersion engineering, adaptive polarization control of waves using chiral metamaterials with real time reconfigurations, optical loss compensation, and modification of light emission. The unique properties of metamaterials arising from their specific configurations opening up exciting new venues for device development in the fields of all-optical data processing, optical meta-

nanocircuits, light collection for solar energy harvesting, superlenses for perfect imaging, perfect mirrors, and electromagnetic cloaks. The project will investigate the possibilities of enhanced light-matter interaction and novel nonlinear optical processes in metamaterials. It will cover fundamental investigations of the origin and the design of effective nonlinearities, as well as their potential for optical devices. The findings will be combined with new design methodologies such as Transformation Optics and Hybrid Optical approaches.

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**NBR: 293578** **ACRONYM: SPIDERMAN** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** Electronic Transport and Spin dynamics through SiGe self-assembled quantum dots

**Abstract:** In 1990 Eaglesham and Cerullo [Phys. Rev. Lett. 64, 1943 (1990)] reported for the first time that three dimensional SiGe islands can be grown crystalline on Si, creating thus high expectations that these nanostructures could provide a valid route towards innovative, scalable and CMOS-compatible nanodevices. Two decades later the researcher has investigated for the first time their electronic properties by fabricating three terminal devices after integrating them on silicon on insulator substrates. The first results obtained so far indicate that SiGe self-assembled quantum dots have a rather unique combination of properties, i.e. low hyperfine interaction and strong spin-orbit coupling. The aim of this project is to study the potential of SiGe self assembled quantum dots for novel nanoscale devices including operation at room temperature. The objective of the present proposal is above all to: a) study spin-dependent transport in self assembled QD aiming to identify signature of spin precession induced by the spin orbit coupling b) study the characteristic time scales for spin dynamics in the SiGe QD system and move towards fully electrical coherent spin manipulation and c) realize a high performance p-type nanoscale transistor operating at room temperature. The experimental research proposed here may provide a new handle on the physics and control of electronic spins in silicon-based nanostructures with possible relevant implications for spintronics and spin-based quantum computation.

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**NBR: 293643** **ACRONYM: BIONANOMUTT** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** Multi-compartmental Biomolecular Nanocarriers for Multi-modal Targeted Therapies

**Abstract:** Nanomedicine is an interdisciplinary field of research that aims to use nanotechnology to improve the pharmacokinetic profile of therapeutics and/or the contrast and

information from medical imaging and diagnostics. The advances in medical treatments that nanomedicine strategies will provide will have a significant socioeconomic impact for the E.U. and is particularly timely due to the aging populations in E.U. member states. This work will use a multi-strategy approach to design novel multicompartmental, multifunctional nanoarchitectures for nanomedicine applications. Lipid nanodiscs will be evaluated as a novel hydrophobic drug carrier and the versatility of the scaffold protein for these discs will be explored by assessing its capacity to form similar complexes with synthetic block copolymers. Multicompartmental, size-limited nanostructures will be developed by using the self-organisation of functional amphiphiles into anisotropic subunits as building blocks for superstructures of greater complexity and functionality. The basic building blocks explored will consist of liposomes, polymersomes and hydrid lipopolymersome structures as well as protein-stabilised lipid nanodiscs. This project will also explore incorporating quantum dots into these nanoarchitectures as an added imaging modality. Finally, through multidisciplinary collaboration of basic scientists through to clinicians, an adjuvant nanomedicine therapy will be developed for treatment of superficial bladder cancers. These therapeutic nanoparticles will contain therapeutic, imaging and active targeting functionalities to remove residual malignant cells following the surgical resection of tumours.

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**NBR: 293678** **ACRONYM: NANOTOX** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** Nanoparticle - Cell Interactions, a Pathway for Understanding Nanotoxicity: from a Model System to in-vitro System.

**Abstract:** While nanotechnology-based products and nanoparticle mediated solution for a wide range of applications are constantly surface the market, there is increased interest and concern, around the benefits and risks of this technology. As nanoparticles size crosses the barrier of 100 nm, many of the traditional laws break down and other effects and properties start dominating (quantum size effects, extremely high surface energy etc). This raises questions regarding the suitability of traditional methods, such as in-vitro test kits and in-vivo animal models used to evaluate their potential toxicity. It is therefore essential to understand the cell - nanoparticle interaction at a fundamental molecular level in complex or simplified biological environments in order to asses their potential toxicity. Further on this foundation the modulation of the nanoparticle properties will allow for optimal performance in drug delivery, bioimaging, medical device coatings, bio-sensors, biochip development, biofouling protection and mitigate nanotoxicology. The major aim of this research endeavor is to study and understand the interactions that take place at the nano-bio interface, as a function of the particle size and the proteins from the biological environment that have been adsorbed on the surface of the particle. To achieve that we propose the utilization of two state of the art surface sensitive techniques; ie the Atomic Force Microscope and the Acoustic Biosensors, that will be

used either separately or in combination for the study of the the interaction force and the structural changes that occur. Initially these interactions will be studied on a simplified membrane model, to avoid complex interactions, a supported lipid bilayer, in order to understand the foundation of these interactions, and later transition to an in-vitro model, an actual cell, to study the interaction in a natural, more realistic environment.

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**NBR: 293687** **ACRONYM: ULTRA PARTICLE** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** Ultra precise nanoparticles to harvest light

**Abstract:** Solar energy is an attractive source of alternative energy contributing to fossil fuel independence. Research is still needed to bring down the cost of solar cells for commercial use. For this, novel concept solar cell research make use of low cost materials with novel techniques, often at the nanoscale. The main aim of this grant proposal lays in the development of ultra precise nanoparticles with sizes where quantum confinement becomes dominant. With these so called quantum dots (QD) the band gap of any semiconductor can be tailored by changing the size thereby harvesting different parts of the solar spectrum. The applicant has worked for 8 years outside the Netherlands and will endeavour to establish a new research line in quantum dot photovoltaics. This Career Integration Grant will help him to reach a solid starting point from which to apply to project funding in national and international consortia. A nanoparticle source (gas aggregation in vacuum) will enable the production of ultra precise nanoparticles (silicon, germanium, etc), i.e. high size control, which will considerably enhance the quality of the QD solar cell and the involved processes. A second research theme is the use of plasmonics of metal nanostructures (particles) to enhance optical absorption in solar cells. Both field enhancement and plasmonic coupling will be explored. The applicant has extensive international research experience in the field of nanoparticles. Combined with the host expertise in photovoltaics this forms a formidable effort to advance the science and technology of novel concepts in solar cells. The applicant has a tenure track assistant professor position and will start his own research team within the host group. The existing infrastructure and expertise are readily available to make this project a success resulting in a permanent position for the applicant and significant contribution to frontier solid state physics research towards a highly efficient and cheap solar cell.

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**NBR: 293797** **ACRONYM: COSPINNANO** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** Coherent spin manipulation in hybrid nanostructures

**Abstract:** The rapid development of novel nanoelectronic devices utilizing the spin degree of freedom of the charge carriers and thus reaching beyond the limitations of traditional semiconductor based technologies is one of the central issues in nowadays spintronics. A special emphasis is put on the fabrication and investigation of hybrid nanostructures exploiting the complementary benefits of metallic, semiconducting, magnetic as well as the recently explored, low dimensional carbon based systems (carbon nanotubes, graphen). The proposed project aims to design various hybrid nanostructures defined by optical and electron beam lithography and to develop novel schemes for determining spin-related material parameters (g-factor, spin diffusion length, spin-injection efficiency and spin transfer torque) via transport measurements. This is essential in order to explore electron spin dynamics, decoherence and relaxation for multifunctional applications (fast switching elements, combined logical and storage devices, quantum dot based semiconductor spin qbits) and to determine conditions for coherent spin-transfer in nano/micro-circuits as well as methods of detection of spin currents. These experiments help to understand and control the coherent spin states of individual charge carriers, which is fundamental for the field of quantum computation in a solid state environment. The host institute possesses all the necessary nanofabrication facilities and the high-end cryogenic background for the successful implementation of device fabrication and low-level magnetotransport measurements. The host has also pioneered the measurement technique for determining spin-polarization and spin transfer torque in nanoscale magnetic systems with a resolution down to the scale of atomic junctions.

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**NBR: 293814** **ACRONYM: MN-LN SMMS** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** Synthesis and characterization of Mn-Ln polynuclear complexes with interesting magnetic properties by the use of diol type ligands

**Abstract:** Nanoscopic magnetic materials are of increasing interest because of their potential use for ultrahigh – density information storage, quantum computing, sensing and biomedical applications. Among the various types of nanoscopic magnetic materials, single molecule magnets (SMMs) represent a family of promising, for use in the above mentioned technological applications, molecule – based magnetic materials. SMMs are molecular transition-metal clusters that retain their magnetization below a blocking temperature (TB or Tcritical) in the absence of an applied field. In order to employ molecule-based materials in technological applications it is important to prepare SMMs with larger thermodynamic barriers (U) and effective (kinetic) barriers (Ueff) to

magnetization reversal and the synthesis of polynuclear heterometallic Mn/lanthanide (Ln) species seems an attractive approach for achieving this. The main idea behind this approach is to combine Mnn+ and Ln3+ ion's significant spin and/or their large anisotropy to generate Mn/4f SMMs distinctly different from, and superior to, the homometallic ones. The specific scientific and technological objectives of this project include: 1) the preparation of new Mn-Ln-L (L = diol-type ligands) clusters and SMMs, 2) the development of new synthetic procedures to polynuclear Mn-Ln clusters and SMMs, and 3) the complete structural and magnetic characterization of the compounds. The complete magnetic and structural characterization of the compounds is essential in order to rationalize their magnetic properties on the basis of their structural characteristics and finally to achieve optimization of their SMM properties by performing controlled structural modifications.

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**NBR: 293834** **ACRONYM: CARBONQUBITS** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** Quantum Bits in Carbon Nanostructures

**Abstract:** Quantum computation (QC) is expected to improve the efficiency of certain computational tasks. QC schemes are formulated in terms of operations on quantum bits (qubits), whose values are superpositions of two quantum states. A natural candidate for the physical implementation of a qubit is the spin of an electron. In fact, breakthrough experiments recently demonstrated the ability to initialize, manipulate, couple and read out spin-based qubits using electrons confined in a solid state environment. New perspectives have been opened in solid-state QC by recent proposals exploiting the peculiar characteristics of carbon nanotubes (CNTs): utilizing electronic states circulating around the CNT circumference in qubit implementation is promising for various reasons. To evaluate the potential in these novel qubit realizations, we plan to develop a profound theoretical understanding of the physical mechanisms allowing initialization and readout of the qubit, causing two-qubit interactions, as well as those leading to the loss of information encoded in the qubit. We expect that our results will enable the design of carbon nanostructures optimized for QC, provide understanding of related recent and future experiments, and highlight fundamental new quantum-physical phenomena on the nanoscale. The completion of the project requires tools of condensed matter theory (tight-binding and envelope-function models, theories of hyperfine, spin-orbit, exchange and electron-phonon interactions), and the theory of non-equilibrium quantum systems (quantum master equation). The EU contribution would enable the applicant to establish himself in Hungary after his mobility period, contribute significantly to the scientific success of his research career, improve considerably the prospects of his permanent integration, allow the transfer of knowledge he has acquired abroad, and enable him to maintain co-operation with the scientific and industrial environment of the countries he visited.

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**NBR: 293861** **ACRONYM: FUMASSY** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** Functional materials through surfactant self-assembly

**Abstract:** I seek the Marie Curie Career Integration Grant grant to support my effort to establish a new independent research group lead by me in the Department of Chemistry at Aalto University School of Chemical Technology, Finland. I am a young Finnish researcher, who after finishing her doctoral studies in December 2004, moved to United States for her post-doctoral research and ever since has been successfully pursuing a research career in top US research environments currently in Yale University and before that in Princeton University. Research in the Sammalkorpi group will apply computational and theoretical methods toward engineering drug delivery, biosensing, and separation membrane systems based on surfactant self-assembly. Amphiphilic surfactant aggregates and their capacity to change form, structure, and dynamics lie at the heart of many natural and synthetic processes. For example, lipid and detergent micelles, vesicles, and membranes play a key role both in cellular and synthetic molecular transport and regulation [Schmidt, Nature (2002); Hubbell, Science (2003)]. The same molecules form tunable coatings, lubrication layers, and novel nanoscale functional soft materials [Min et al., Nature Materials (2008); Hillmyer, Science (2007); van Hest, Nature (2009)]. My initial research will focus on two areas with common themes of molecular self-assembly and the key influence of aggregation on system dynamics: 1) small interfering RNA (siRNA) delivery via micellar and vesicular carriers and 2) novel functional materials based on functionalized carbon nanotubes in amphiphilic surfactant aggregates. I apply the Marie Curie Career Integration funds for 4 years to improve the chances of success I have on establishing this ambitious new line of research in the Department of Chemistry at Aalto University.

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**NBR: 293891** **ACRONYM: RE-ACT** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** Novel active nanophotonic devices in rare-earth doped double tungstates

**Abstract:** The objectve of Re-ACT is to establish the foundations for a long-term research effort in integrated active nanophotonic devices based on the use of rare-earth doped double tungstate crystalline materials. Re-ACT puts together several disruptive leading edge technologies in an innovative manner to solve several important problems that are hindering the complete integration of nanophotonic circuits. Research areas that will be

investigated include plasmonic propagation with gain, gain assisted all-optical processing, integrated optical isolators and the use of plasmonic resonant effects for novel on-chip sensing devices and nanolasers. It is expected that the results obtained in Re-ACT will lead to several breakthroughs that will enable the realization of long searched fully integrated active nanophotonic devices. The possibility to integrate as much functionality on the chip as desired, with almost unlimited bandwidth and with very low power consumption will open the door to new concepts in telecommunications, computing and personal entertainment that will revolutionize the way human communications will take place. Several breakthroughs in diagnostics, medical imaging and environmental monitoring are also expected. In our ageing society, there is an increasing need for technologies enabling non-invasive medical diagnostics and preventive medicine. Environmental care will benefit from the deployment of distributed networks of very small and sensitive sensors that will help monitoring our fragile resources. Water could become a scarce resource in the future and the importance of having safe water is increasingly becoming a priority. These realizations will be enabled thanks to the development of novel miniaturized microspectrometers and networks of biosensors coupled with arrays of integrated low power consumption nanolasers.

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**NBR: 293932** **ACRONYM: DR-NANO** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** Depth-Resolved Optical Nanoscopy

**Abstract:** A fluorescence microscope for the noninvasive imaging of the structure and dynamics in thick 3D systems with 3D sub-diffraction-limited resolution and at extended penetration depths would have a broad spectrum of applications in both the physical and biological sciences. Conventional fluorescence microscopy techniques, such as confocal and two-photon microscopy, lack the spatial resolution required for measurements at the nanoscale, whereas state-of-the-art 3D super-resolution optical microscopy methods offer limited penetration depth (

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**NBR: 293945** **ACRONYM: VISCONANONET** **EC FUND: 75000**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** Modelling the viscoelasticity of polymer-based nanocomposites guided by principles of non-equilibrium thermodynamics"

**Abstract:** By appropriately adding nanoparticles to a polymer matrix can lead to materials with dramatically improved properties, especially under conditions of good dispersion. From a rheological point of view, polymer nanocomposites are typically considered to be soft colloidal dispersions, with an intrinsically disordered structure that greatly affects their viscoelastic or mechanical properties. Despite that the rheological properties of nanocomposites in the melt can be predicted or explained via entanglement network simulations based on multiscale simulation strategies, large-scale macroscopic calculations of their processing flows requires reliable constitutive (viscoelastic) equations which are currently missing. Our objective in the proposed project is to develop such constitutive models guided by principles of nonequilibrium thermodynamics. In particular, we propose to develop a new family of differential models capable of describing the complicated rheological behavior of polymer nanocomposites as a function of the viscoelastic properties of the native polymer matrix and a few parameters describing polymer-filler interactions. The new models will be thermodynamically admissible and will be validated against experimentally measured data for the linear and non-linear viscoelastic properties of selected systems. They will also be employed in large scale finite- or spectral-element calculations in flows such as extrusion and calendering. The outcome of our work will be new differential constitutive equations capable of explaining or describing a number of intricate phenomena typically observed in the preparation and processing of polymer-matrix nanocomposites: filler alignment for anisotropic fillers, particle clustering, network formation, jamming etc., and their effect on the observed rheological properties (yield stress, stress overshoot, etc.)

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**NBR: 294012** **ACRONYM: SISQ** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** Silicon Spin Quantum Bits

**Abstract:** The objective is realising the first silicon single-electron spin quantum bits, which will be a significant step towards the realization of the first generation quantum computers. Quantum computers are expected to dramatically outperform the largest classical supercomputers in solving specific important problems. Applications involve data encryption (for intrinsically secure communication), the efficient simulation of quantum systems (such as chemical reactions), and support in many emerging forms of artificial nanotechnology, and in our understanding of the nanomachinery of biological molecules. In this proposal CMOS-compatible silicon quantum dots (QDs) are used as hosts for electron spin quantum bits for future solid-state quantum information processing. We will use a unique design which incorporates a large number of independently controllable gates, resulting in an unprecedented degree of tunability in Si QDs. This architecture has allowed for single-electron QDs in silicon. Here, we aim at establishing Pauli spin blockade in the few-electron regime in double QD (DQD) systems,

which will be used as detector for single-electron spin resonance. This will enable us to determine the single electron spin coherence time T2, which holds the promise to be extremely long in Si QDs.

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**NBR: 294025** **ACRONYM: TOUGHBRIDGE** **EC FUND: 75000**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** Bridging microstructural to macroscopic properties in failure of heterogeneous materials

**Abstract:** Nowadays, materials, structures and devices can be designed and fabricated at nanoscale dimensions with controlled microstructures processed “atom by atom”. Predicting their toughness and ensuring their durability over the long term still present a major challenge. These properties esult from the complex interplay between the applied stress conditions at the macro scale and the material heterogeneities at the scale of the microstructure, crucially influenced by processes such s damage, chemical reactions and thermal fluctuations, also occurring at the microscale. Bridging length scales is central in the study of material failure and the main objective of my esearch project is (i) to provide a statistical and quantitative description of the effect of material microstructure on the propagation of cracks and the damage spreading in highly heterogeneous brittle and quasi brittle solids. This will be achieved by investigating experimentally and numerically at the microscale the failure of model systems with controlled heterogeneous properties; (ii) to implement these mechanisms into simplified predictive models based on tools issued both from statistical physics and fracture mechanics. They will link material characteristic nd failure mechanisms at the microstructure scale with their macroscopic failure properties. In the long run, the models developed within this project will help optimizing efficiently the microstructure f a solid in order to achieve improved failure properties, such as strength and lifetime.

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**NBR: 294046** **ACRONYM: DECODEB** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** Defined co-immobilization by DNA binding protein tags

**Abstract:** Defined spatial distribution of proteins plays a major role in nature, like structures for bacterial cell mobility (Escherichia coli’s flagella), capsid structures of viruses, structures for the controlled segregation of chromosomal DNA both in eukaryotic and prokaryotic cells, a large array of membrane protein complexes (e.g. protein transporters and nutrient transporters) and the assembly of channeled metabolic pathways among many others. All these diverse and fundamental processes are the result of the evolution of

very specific and controlled spatial organization of multiple proteins. Defined spatial distribution also plays a major role in many biotechnological applications of proteins, from the immobilization of antibodies on the surface of an electrode for their use in biosensors to the creation of nanostructures through biotemplating. A wide variety of approaches have been developed in order to allow the easy immobilization of proteins, ranging from electrostatic interactions and direct covalent linkage to high affinity non-covalent interactions (e.g. streptavidin/biotin). In order to facilitate the generation of more complex synthetic quaternary protein structures (on surfaces and in solution), we propose the development of a protein fusion tag system that will enable the controlled and orderly precise co-immobilization of proteins by means of protein-DNA interactions. This project aims to take advantage of the highly developed methodologies that currently exist and allow the synthesis and immobilization of DNA with ease and use them as a means for controlled protein co-immobilization. Specifically, to achieve this objective, we propose to develop a panel of high affinity DNA binding proteins with different sequence specificities to be used as fusion tags and provide the protein-DNA interaction link.

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**NBR: 294056** **ACRONYM: GRANOP** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** Graphene Nano-Photonics

**Abstract:** Graphene, a single-atom layer of carbon, has attracted enormous attention in diverse areas of applied and fundamental physics. Due to its unique crystal structure, the charge carriers have zero effective mass and can therefore travel for micrometers without scattering, even at room temperature. While graphene-based devices have an enormous potential for high-speed electronic devices, it has recently also been recognized as a photonic material for novel optoelectronic applications. Surprisingly, little attention has been devoted to graphene-based nanophotonic applications where optical fields are confined far below the diffraction limit. Due to its ultrasmall thickness and extremely high purity, it supports extremely strong wave localization at the nanoscale (also identified as surface plasmons) with relatively low losses. Moreover, graphene can be tuned from a semiconductor to a metal simply by applying a gate voltage, holding promise for in-situ tuneability of strong light-matter interactions at a length scale far below the wavelength. This makes graphene the ideal material to synergize nano-optics and electronics at the nanoscale. This research will demonstrate the application of graphene as a novel nano-photonic material that outperforms greatly existing photonic materials (cavities and metals). We will engineer ultra-strong and coherent light-matter interactions between single emitters and graphene, and implement several quantum electrodynamics (QED) applications. This research will address fundamentally new phenomena associated to the peculiar properties of graphene, while the development of this novel type of integrated nano-optoelectronic device will enable potential

applications ranging from nanoscale (quantum) optical switches and quantum information processing, to super-efficient light collection, and ultra-fast and sensitive sensing of single (bio) molecules.

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**NBR: 294061** **ACRONYM: FDBNSDNA** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** Force-Dependent Behaviour of Non-Standard DNA Structures and their Uses in Artificial DNA Machines and in Genetic Regulation

**Abstract:** Since the physicist Richard Feynman famously remarked that "[t]here is Plenty of Room at the Bottom" half a century ago, rapid advances in science have shown us that these words do not only apply to the realm of physics, but equally well to all other the disciplines that make up the exciting fields of biophysics and life sciences. However, the chemistry, biology, and physics we find at this "bottom", at the level of individual molecules and molecular aggregates, are succinctly different from what one encounters on the macroscopic scale: thermal motion becomes important, while inertia plays a very minor role; and the statistics of large numbers encountered in the test tube have to be replaced with analysis of discrete interaction between a few partner molecules. From this follows that all structures build from nanometre sized (molecular) units and all their interactions are highly dynamic and susceptible to disturbances by exceedingly small forces in the low pico-newton (10^-12 N) range. The aim of this career integration proposal is to expand my previous work on the effects of small mechanical forces in the interaction of DNA with regulatory proteins, and extend it to establish the dynamic mechanical parameters of novel non-standard, self-assembled DNA structures based on the self-recognition of the DNA base guanine, which show potential as building blocks for future molecular-scaled devices and electronics ("G-wires"). Putative poly-guanine structures have been reported to occur ubiquitously in the human genome, where they make up the highly repetitive ends of chromosomes (telomers) and are found throughout regulatory sequences of the genetic code ("G-quadruplexes"); this makes them potential targets for therapeutic drugs in the fight against cancer. Although the chemical environment needed for assembly has been studied, little to nothing is known about their physical properties, especially on the biologically and technologically relevant single molecule level.

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**NBR: 294094** **ACRONYM: NANOLIGHT** **EC FUND: 75000**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** Synthesis and characterization of NANOstructured materials with LumInescent properties for diaGnostic and tHerapeuTic applications

**Abstract:** The aim of the present project is to explore different synthesis strategies to obtain silicon nanocrystals and carbon nanodots with luminescent properties as alternative to conventional fluorescent biomarkers or other light-emitting semiconductor nanoparticles containing heavy metals known as quantum dots. Nanostructured silicon can provide appealing properties such as size and wavelength-dependent luminescence emission in the red/near infrared window, resistance to photobleaching, and robust surface chemistry for grafting of bio-molecules without incurring the burden of intrinsic toxicity or elemental scarcity of quantum dots. Carbon-based nanostructures with fluorescent properties remain relatively unexplored but similar behaviour and properties can be envisaged. The production of silicon nanocrystals will be approached by means of two different methods: i) thermal processing of silesquioxanes to produce an encapsulating oxide matrix for the silicon nanocrystals and ii) laser pyrolysis of silicon precursors either in gas phase or in the form of aerosols containing organometallic precursors. Both methods are quite novel and offer great possibilities for scaling up the batch production of silicon nanocrystals offered by current methodologies. Likewise, the synthesis of carbon nanodots will be explored by both thermal decomposition and laser ablation of carbon-containing precursors. To stabilize the nanoparticles and render them biocompatible for in vitro and in vivo diagnostic imaging experiments, different passivating and encapsulating agents like alkyl or alkoxy-groups and micelle-forming polymers and phospholipids will be evaluated. Finally, fluorescent labelling of cells, evaluation of cytotoxicity, drug-loading, circulation and degradation of selected samples will be carried out.

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**NBR: 294098** **ACRONYM: THERAVAC** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** Development of a therapeutic HPV vaccine via target epitope identification by mass spectrometry

**Abstract:** At least 20% of human malignancies are caused by consequences of persistent infections. High-risk human papillomavirus (HPV) types cause over 500.000 cancer cases per year, rendering HPV the #2 human carcinogen after tobacco. Infection-related tumors are attractive targets for cancer vaccination, as they provide the opportunity to target antigens that are immunological non-self. Vaccination can be prophylactic, inducing immune responses preventing infection in the first place, or therapeutic, stimulating the immune system into eradicating established disease. Prophylactic immunization against HPV has become the paradigm for cancer immunoprevention. Unfortunately, current HPV vaccines have no therapeutic effect on existing infections. Studies on spontaneously regressing HPV-induced lesions show that cell-mediated

immune responses are crucial in clearing established HPV infection. Cytotoxic T cells (CTL) kill infected cells after recognizing viral epitopes presented on HLA molecules on the cell surface. There are hundreds of different HLA types, and a given epitope is only applicable for the fraction of patients with the relevant HLA molecule. This project will define a set of T cell epitopes that elicit CTL-mediated HPV protection in the entire population, by including epitopes for all HLA supertypes. The applicant has established a methodology of determining which viral epitopes are presented on target cells during her past mobility period in the US. HPV-transformed cells of various HLA backgrounds are analyzed by nanospray mass spectrometry. Identified peptides are tested for immunogenicity and the ability to induce CTL. From these tests, a minimal set of functional epitopes providing >95% population protection coverage is selected for vaccine formulation. The technology is currently transferred to the DKFZ. If this epitope-specific, yet widely applicable therapeutic vaccination approach is successful, it can be used as a platform technology in other malignancies.

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**NBR: 294158** **ACRONYM: COOL** **EC FUND: 91666**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** First-principles engineering of thermal and electrical transport at the nanoscale

**Abstract:** There is great hope to tackle serious global issues related to energy consumption and waste by developing technologies based on efficient nanoscale materials and devices. For this to happen, we need breakthroughs in our ability to control electrical and thermal transport at the nanoscale. Ab-initio materials modelling will play a central role in this, providing microscopic understanding and the materials parameters needed to bridge the macroscopic performance and the microscopic mechanisms that determine transport properties. In this project I will use ab initio techniques based on density-functional theory to calculate the electronic and vibrational properties of materials as well as the carriers' relaxation times due to carrier-carrier and carrier-defect interactions. These are the key ingredients that will then be used in the Boltzmann transport equation to simulate transport in devices, taking into full account the coupled electron-phonon dynamics in complex geometries, and in the presence of interfaces or defects. The research will proceed in three main directions. First, toward engineering materials and devices for high-performance nanoelectronic applications. Here I will study the detailed mechanisms of carrier-induced heating in silicon- and carbon-based electronic devices: this is a key technological issue that is becoming dominant as we race toward the nanoscale. Second, toward identifying new optimal thermoelectric materials, which are of great relevance to energy conversion or cooling applications. To this end, I will perform a systematic study of the thermoelectric properties of promising materials, starting from ternary and filled CoSb3-based skutterudites. Third, toward characterizing structural and spectroscopic properties of materials and devices. Here I will place

particular effort in building a database of thermo-mechanical and spectroscopic properties of the materials that show the most promising transport characteristics.

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**NBR: 294168** **ACRONYM: COSYMETCOX** **EC FUND: 87500**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** Confined synthesis of metastable complex oxides

**Abstract:** Nowadays, a pressing demand for new materials with appealing multifunctional properties is pulling the research in materials science. In this context, as the properties of inorganic solids are intimately linked to their crystal structures, an interesting approach to extend the range of properties and applications of a particular compound is discovering and stabilising at ambient conditions new metastable polymorphs of thermodynamically stable structures. A fruitful strategy to stabilize metastable phases is the synthesis of nanoscale polymorphs under matrix confinement. Interestingly, some of those metastable polymorphs which can only be stabilized in spatially restricted fields, display outstanding multifunctional properties that could find important technological applications. Exploring, identifying and understanding the fundamental aspects of this stabilizing mechanism will be the first objective of the project. Some model metastable polymorphs with applicability in Information and Communication Technologies as memory or sensor devices that will be investigated in the project are: ε-Fe2O3, λ-Ti3O5 and a new phase of La0.7Sr0.3MnO3. The matrix confined synthesis is not always well matched for the integration of these nano-oxides into devices which requires a thorough control of the microstructure of the functional oxides and its precise positioning in a technological substrate. Addressing the above limitation is the second leading objective of the project.

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**NBR: 294186** **ACRONYM: EXOTICPHASES4QIT** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** Exotic quantum phases in graphene and other modern nanomaterials - physical foundation for quantum information technology

**Abstract:** Project covers theoretical/computational studies of exotic phases of quantum matter (especially with fractional and non-Abelian quantum statistics) in graphene and other modern nanomaterials. It is aimed at both fundamental effects and application in future graphene nanotechnology (especially in quantum information technology, via the concept of topological quantum computation). Major goals are: (i) implementing powerful computational methods acquired during the preceding IEF (large scale

configuration interaction, quantum Monte Carlo, density functional theory) for application in modelling electronic structure and many-body effects in nanostructures; (ii) understanding new many-body effects in low-dimensional systems (especially those related to emergence of exotic electronic phases), applicable in quantum information technology; (iii) building a research group focused on nanoscience/nanotechnology, benefitting from collaboration with University of Cambridge established during the IEF. Project's success relies on Applicant's experience (mostly in fundamental research, but also in teaching and leadership), previous and gained during the preceding IEF, and on superb quality of research groups with whom collaboration has been established during the IEF (Cambridge, Oxford, Penn State). The main results will be: (i) improved understanding of the studied phenomena; (ii) shared collaboration between group at host institution (WrUT) and host of previous IEF (Cambridge), including student/lecturer exchange and joint research.

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**NBR: 294214** **ACRONYM: MEMBRANE PROTEINS** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** Visualizing the structure and function of elusive membrane receptor proteins of the human cell

**Abstract:** Knowledge of the structure of proteins can provide an in-depth understanding of biology and lead to critical insights into the origins of human disease. Numerous proteins important in biology and disease are, however, not amenable to structural analysis by traditional methods. A family of proteins that are notoriously difficult to study are membrane proteins. Membrane proteins are extremely important to study as they play pivotal roles in most biochemical processes of the cell, account for up to 25 percent of all proteins in humans, and represent nearly two-thirds of the proteins that can be targeted by drugs. These proteins are, however, difficult to access experimentally due to their hydrophobic nature and because they need to be associated with lipids from the cell membrane. Most techniques are not readily compatible with the combination of lipids and proteins, especially those that are used to reveal the three-dimensional structure of proteins (i.e. NMR spectroscopy or x-ray crystallography). Alternative techniques are needed to gain insight into the structure of membrane-bound proteins. We propose to meet this challenge by employing an alternative technology that use mass spectrometry to measure the hydrogen/deuterium exchange (HX) of proteins in solution. The objective of this project proposal is to apply HX-MS technology to study two "difficult" membrane proteins of key biological function: (1) the T-cell receptor (TCR) and (2) the Epidermal Growth Factor Receptor (EGFR). By inserting these receptors into nanoscale lipid bilayer discs and measuring the HX of the proteins, we will extract detailed information about their higher-order structure and molecular interactions using only small amounts of material at dilute biological conditions. The proposed project is innovative as we combine nanotechnology with alternative analytical methodology to

supply critical and currently missing structural details about two important cell-surface receptor proteins.

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**NBR: 294240** **ACRONYM: NEWDFTFUNCT** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** Development of new non-empirical DFT functionals.

**Abstract:** Nowadays the application of computational chemistry extends to the realm of bioinorganic, organic and nanotechnology molecules, whose size impedes the use of purely ab initio methods, leaving density functional theory (DFT) as the only recourse to model chemical reactions. The accuracy of DFT calculations depends critically on the quality of functionals used and, as a result, in the last years there has been a craving for new density functionals. Many functionals have been designed, often based on the parameterization of existing ones. While this research brings accurate functionals for very particular purposes, it does not pave the way for long-lasting all-purpose ones. A universal functional should be constructed from physical constraints or model systems, which cover a wide range of molecular situations. Harmonium, a model system alike to an ordinary atom, permits an easy tuning of electron correlation effects, thus being a formidable test bed for DFT methods. The researcher has designed an algorithm to calculate highly accurate energies and wavefunctions of few-electron harmonium systems, which are used to calibrate a large number of DFT functionals. From the benchmark calculations obtained from few-electron harmonium he will design a new version of Müller's functional driven by the amount of electron-correlation introduced in the system. He will also construct a non-empirical DFT functional by imposing appropriate physical constraints. Finally, in order to improve the performance of the functional a hybridized form of latter will be constructed. The designed DFT functionals will not be just an evolution of the current ones, but a new type. Thus, they could solve some of the critical problems of the current functionals. There are very few groups in Spain working in the development of new functionals. This project will pursue this goal employing a very genuine strategy, and holds the promise to provide relevant results for the development of DFT methods.

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**NBR: 294263** **ACRONYM: NANOPHOCAT** **EC FUND: 75000**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** Nanoparticles as photocatalysts: understanding their interaction with light

**Abstract:** The industrial need for green, cost effective catalysts is crucial. Recently, attention has been placed on the generation of novel catalysts that can be developed at a minimal cost and efficiently yield the desired products. The general aim of the project is to use light-driven strategies to design nanosystems and develop novel photocatalysis, by using the interaction of these nanosystems with light. The topic of this project is integrated in an area of great actuality and potentiality, at the intersection between nanotechnology, organic chemistry, the design of functional molecules, supramolecular chemistry, and photochemistry/photophysics. Since light is being used for so many different applications in the area of nanotechnology, it is crucial to understand the effect of light excitation on the nanoparticles (NPs) and which processes can be derived from these light-nanosystem interactions. Thus, the specific objective of this project is to gain knowledge about how light-driven strategies can be applied to: 1) make colloidal nanodevices, as well as for controlling their size- and/or shape- modification, i.e., application of light as a tool for the preparation of functional nanodevices; and 2) use the photochemical and photophysical properties of new or known nanomaterials to develop new synthetic routes. Switchability of NP in the systems under study will also be explored. These objectives will be achieved by developing the proposed work plan at The Institute of Molecular Science at the University of Valencia under the supervision of Prof. Perez-Prieto. The candidate has signed already a contract for three years starting in September 2011 and is willing to transfer the knowledge she has acquired in Canada working in Prof. Scaiano's group, to the European Community. During these three years she will develop her strong carrier plan that would allow her to consolidate and establish her scientific career in Europe.

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**NBR: 294343** **ACRONYM: NITRICARE** **EC FUND: 2499107**

**DG:** ERCEA **Call: ERC-2011-ADG_20110310** **Thema:** ERC-AG-LS8

**Title:** Nitrification Reloaded - a Single Cell Approach

**Abstract:** Nitrification is a central component of the Earth's biogeochemical nitrogen cycle. This process is driven by two groups of microorganisms, which oxidize ammonia via nitrite to nitrate. Their activities are of major ecological and economic importance and affect global warming, agriculture, wastewater treatment, and eutrophication. Despite the importance of nitrification for the health of our planet, there are surprisingly large gaps in our fundamental understanding of the microbiology of this process. Nitrifiers are difficult to isolate and thus most of our current knowledge stems from a few cultured model organisms that are hardly representative of the microbes driving nitrification in the environment. The overarching objective of NITRICARE is to close some of these knowledge gaps and obtain a comprehensive basic understanding of the identity, evolution, metabolism and ecological importance of those bacteria and archaea that actually catalyze nitrification in nature. For this purpose innovative single cell technologies like Raman-microspectroscopy, NanoSIMS and single cell genomics will be

combined in novel ways and a Raman microfluidic device for high-throughput cell sorting will be developed. Application of these approaches will reveal the evolutionary history and metabolic versatility of uncultured ammonia oxidizing archaea and will provide important insights into their population structure. Furthermore, the proposed experiments will allow us to efficiently search for unknown nitrifiers, evaluate their ecological importance and test the hypothesis that organisms catalyzing both steps of nitrification may exist. For non-model nitrifiers we will develop a unique genetic approach to reveal the genetic basis of key metabolic features. Together, the genomic, metabolic, ecophysiological and genetic data will provide unprecedented insights into the biology of nitrifying microbes and open new conceptual horizons for the study of microbes in their natural environments.

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**NBR: 294438** **ACRONYM: CELLUFUEL** **EC FUND: 2351450**

**DG:** ERCEA **Call: ERC-2011-ADG_20110310** **Thema:** ERC-AG-LS1

**Title:** Designer Cellulosomes by Single Molecule Cut & Paste

**Abstract:** Biofuel from wood and waste will be a substantial share of our future energy mix. The conversion of lignocellulose to fermentable polysaccharides is the current bottleneck. We propose to use single molecule cut and paste technology to assemble designer cellulosoms and combine enzymes from different species with nanocatalysts.

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**NBR: 294443** **ACRONYM: COSIMO** **EC FUND: 2499999**

**DG:** ERCEA **Call: ERC-2011-ADG_20110310** **Thema:** ERC-AG-LS9

**Title:** COVALENT SINGLE-MOLECULE CHEMISTRY OF THE CELL

**Abstract:** A label-free single-molecule technology developed the PI's laboratory will be exploited to elucidate covalent chemistry of relevance to the cell. The approach uses an engineered protein pore that passes a non-perturbing current carried by aqueous ions. Covalent bond making and breaking events within this nanoreactor are registered as step changes in the ionic current that reveal the kinetics of each reaction step. No perturbing reagents, such as fluorophores, are required. Single-molecule chemistry provides insights that are not forthcoming from ensemble experiments. For example, all the intermediates in a reaction are revealed in the correct sequence; a fast step that follows a slow step is readily observed; branched pathways can be dissected. We have demonstrated the feasibility of the nanoreactor approach and now we will build on its considerable potential by deciphering and quantifying three aspects of cellular chemistry that encompass basic science and biotechnology: 1. various reactions that

occur in cells and tissues (e.g. nitrosothiol second messenger chemistry); 2. the chemistry of reagents for use in cell biology (e.g. the site-specific attachment of fluorophores to proteins); 3. the development of single-molecule sensors for cells and tissues (e.g. sniffer pipets).

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**NBR: 294724** **ACRONYM: CRYOTRANSLATION** **EC FUND: 2995640**

**DG:** ERCEA **Call: ERC-2011-ADG_20110310** **Thema:** ERC-AG-LS1

**Title:** High Resolution cryo-EM Analysis of Ribosome-associated Functions

**Abstract:** Translation of the genetically encoded information into polypeptides, protein biosynthesis, is a central function executed by ribosomes in all cells. In the case of membrane protein synthesis, integration into the membrane usually occurs co-translationally and requires a ribosome-associated translocon (SecYEG/Sec61). This highly coordinated process is poorly understood, since high-resolution structural information is lacking. Although single particle cryo-electron microscopy (cryo-EM) has given invaluable structural insights for such dynamic ribosomal complexes, the resolution is so far limited to 5-10 Å for asymmetrical particles. Thus, the mechanistic depth and reliability of interpretation has accordingly been limited. Here, I propose to use single particle cryo-EM at improved, molecular resolution of 3-4 Å to study two fundamental ribosome-associated processes: (i) co-translational integration of polytopic membrane proteins and (ii) recycling of the eukaryotic ribosome. First, we will visualize nascent polytopic membrane proteins inserting into the lipid bilayer via the bacterial ribosome-bound SecYEG translocon. Notably, the translocon will be embedded in a lipid environment provided by so-called nanodiscs. Second, we will visualize in a similar approach membrane protein insertion via the YidC insertase, the main alternative translocon. Third, as a novel research direction, we will determine the structure and function of eukaryotic ribosome recycling complexes involving the ABC-ATPase RLI. The results will allow, together with functional biochemical data, an in-depth molecular structure-function analysis of these fundamental ribosome-associated processes. Moreover, reaching molecular resolution for asymmetrical particles by single particle cryo-EM will lift this technology to a level of analytical power approaching X-ray and NMR methods. ERC funding would allow for this highly challenging research to be conducted in an internationally competitive way in Europe.

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**NBR: 294745** **ACRONYM: GTNCTV** **EC FUND: 2499958**

**DG:** ERCEA **Call: ERC-2011-ADG_20110310** **Thema:** ERC-AG-LS7

**Title:** Gene therapy and nanotechnology based CNS targeted vectors

**Abstract:** Targeting therapeutic genes selectively into the central nervous system (CNS) is a crucial precondition for translation of gene therapy strategies into human trials. The current multidisciplinary proposal integrates expertise identified as essential in the effective acceleration of research to overcome bottlenecks in the field including: 1) Inefficiency of therapy delivery to the CNS because of factors like the blood-brain barrier (BBB); 2) Poor understanding of disease mechanisms at the molecular and cellular levels. These problems must be overcome to develop fully effective treatments for neurological disorders. Currently the adeno-associated (AAV)-based system is one of the most refined and effective gene delivery systems for neuronal cells. In contrast to all other systems, it has been possible to engineer AAV9 to deliver genes through the BBB to the CNS by intravascular (IV) administration. However, following IV delivery, these vectors also target liver and other tissues, with significant potential for untoward effects. This has prompted us to adopt two major strategies: i) targeting of AAV9 vectors at the level of transcription by insertion of hybrid motor neuron specific promoters into the vector genome; ii) development of a CNS-targeted delivery approach based on state-of-the art nanoparticle-mediated encapsulation of AAV9 vectors. We anticipate that engineering strategies with the ability to restrict transgene expression to CNS tissue will significantly overcome various existing hurdles in CNS gene therapy development. Our objectives are to: 1) explore mechanisms leading to penetration of scAAV9 vectors through BBB since the exact mechanism of AAV9 diffusion through BBB is unknown; 2) design novel targeted strategies with enhanced tropism to CNS; 3) use CNS targeted vectors to investigate mechanisms of motor neuron death linked to mutations in RNA processing genes; 4) utilise CNS-targeted systems to test therapeutic strategies for motor neuron diseases.

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**NBR: 294901** **ACRONYM: PEPTIDE NANOSENSORS** **EC FUND: 191400**

**DG:** REA **Call: FP7-PEOPLE-2011-IRSES** **Thema:** FP7-PEOPLE-2011-IRSES

**Title:** Development of Electrochemical Peptide Nanosensors for protein and antibody detection"

**Abstract:** The overriding goal of the proposed research program is the development of novel reagentless, electrochemical peptide based sensors for the detection of multiple diagnostic proteins. The approach, which will utilize electrochemistry to monitor the binding-induced folding of peptide/polypeptide used as recognition elements, will be rapid, specific, convenient, and critically, selective enough to be employed directly in blood serum and –we propose- whole blood. This goal will be achieved bringing together an international and interdisciplinary group of research teams and building a collaborative environment for research, innovation and technology transfer in the field of electrochemical nanosensors. This program will allow the exchange of knowledge and

expertises through training visiting periods of early stage and experienced researchers. The training will involve each single aspect of sensor development. For this reason, the research teams selected encompass all of the requisite expertises and each of them has a particular focus on a single step of sensor production and testing. The outcome of the fellowship will be crucial for the early stage researchers involved. This in fact will strengthen their scientific knowledge through a focused training at the host institutions and will facilitate the acquisition of experience in new, interdisciplinary fields at the interface of analytical chemistry, electrochemistry, molecular biology and clinical chemistry. The program will also allow the exchange of experienced researchers. This will give the possibility to build a strong net of collaboration, which will be very important for future careers of the involved scientists. The laboratories involved have similar objectives but with completely different scientific approaches and expertise, this program will help the integration and collaboration among the research teams and the establishment of a long-term collaboration between Europe and key Third Countries.

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**NBR: 294952** **ACRONYM: NANOTWINNING** **EC FUND: 498696**

**DG:** RTD **Call: FP7-INCO-2011-6** **Thema:** INCO.2011-6.1

**Title:** Increase in opportunities for strategic collaboration in the field of nanotechnology via twinning of IOP with institutions of European Research Area

**Abstract:** The Nanotwinning Project is aimed at one of FP7 Thematic priorities - Nanosciences, Nanotechnologies, Materials & new Production Technologies. The project provides a number of events, which are focused on increasing opportunities for collaboration in the field of nanotechnology via twining of IOP with institutions of ERA. The Institute of Physics of the National Academy of Sciences of Ukraine (IOP) is the coordinator of the Project. European partners of Nanotwinning Project, namely Pierre and Marie Curie University (France), the University of Torino(Italy), the University of Tartu (Estonia) are well recognized in the world in the field of nanotechnology and European Profiles (Greece) will assist in creation of strategic plan of development of the IOP. There are 5 Work packages (WPs) provided in the Nanotwinning Project: the 1st WP is aimed at general coordination, achievement of all project milestones and implementation of the Project. The 2nd WP is an integration of scientists of IOP in ERA by experience exchange, creation of joined Surface enhanced spectroscopy laboratory and holding of "Nanobiophysics" conference. The 3rd WP provides involvement of youth into promising directions of research by open days in the Institute, issuance of short-term grants for training, travel grants for participation in conferences and holding of international summer school "Nanotechnology: a Hands-On Experience with Fundamental Background and ways of raising Finance in the science". The 4th WP is the search for ways of additional funding attraction into science and innovations – it is planned to hold short-term theme workshops, technological meetings, where not only representatives of science and external experts, but also representatives of business will be involved. On

the last stage (WP5) the system of strategic management of IOP will be improved by creation of plan of the Institute sustainability for the next 5 years.

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**NBR: 294953** **ACRONYM: MOLD-NANONET** **EC FUND: 474999**

**DG:** RTD **Call: FP7-INCO-2011-6** **Thema:** INCO.2011-6.1

**Title:** Enhancing the capacities of the ELIRI Research Institute in applied research to enable the integration of Moldova in the European Research Area on the basis of scientific excellence

**Abstract:** The objective of MOLD-NANONET is to assist the ELIRI Research Institute to develop and implement a research strategy that will expand its activities and increase its level of excellence in micro-nano-electronics related to the development of intelligent systems, so that it can compete and collaborate with leading research institutions in Europe. MOLD-NANONET will create a unified infrastructure in Moldova by integrating the R&D capabilities of the city of BELTI with those of the capital city (Chisinau). Training activities will be opened up and integrate with activities in other relevant research institutions in Moldova and with the new Technological Park affiliated to ELIRI. MOLD-NANONET will stimulate the creation of a bridge between applied research and innovative business. Focus is on a new research and training program for young researchers at ELIRI and BELTI in integrated nanostructure networks for implementation in intelligent systems. This will be realized through: - Combining existing facilities at ELIRI in the field of micro-nano-technology with new equipment to extend the expertise to integrated networks of nanostructures based on magnetic, thermoelectric and shape memory metals for applications in intelligent systems based on synergetic integration of nanoelectronics, fine mechanics, product design and soft development. - Establishment of a training program to integrate the principles of nanoscale science in research and coursework for the development of a new generation of experts at the intersection of nanoelectronics, fine mechanics, product design and soft development. - Training modules to teach Master and PhD students how to promote a new technology, novel material or device to the market via technology transfer based on innovation. - Training modules will assist researchers and staff from across Moldova to attain a practical understanding of FP rules and regulations and receive training to increase success in FP proposals.

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**NBR: 294955** **ACRONYM: DOSECOPS** **EC FUND: 327600**

**DG:** REA **Call: FP7-PEOPLE-2011-IRSES** **Thema:** FP7-PEOPLE-2011-IRSES

**Title:** Development of sustainable electrochemical corrosion protection systems for reinforced concrete structures

**Abstract:** Corrosion of reinforcing steel in concrete structures is a worldwide problem and affects a large number of infrastructures. Two major causes connected to corrosion of reinforcing steel are the carbonation and chloride attack. Concrete carbonation produces a carbonated surface layer in which the pore solution pH value is depressed to near-neutral levels. A fall in pH to values below 10 at the steel can render the steel passive film thermodynamically unstable and thus cause steel corrosion. While chloride attack causes localised breakdown of the passive film that initially forms on steel as a result of the alkaline nature of the pore solution in concrete. The harmful chloride ions can be originated from the use of contaminated mix constituents or from the surrounding environment such as deicing salts or seawater. The corrosion of steel not only reduces the strength of reinforcement but also can lead to cracking and spalling of cover concrete because of the substantial volume increase that accompanies the transformation of iron to rust. To promote the effective application of reinforced concrete it is important to protect the reinforcing steel from corrosion during its service life. This proposal is to explore a new electrochemical remediation of reinforced concrete structures by combining conventional electrochemical processes, such as the electrochemical chloride removal for chloride contaminated concrete and the electrochemical realkalisation for carbonated concrete, with electrochemical nanoparticle injection. Using the new electrochemical processes, not only can they remove chlorides from concrete and increase alkalinity in concrete pore solution but also simultaneously inject nanoparticles into the concrete to enhance its mechanical properties as well as improve its porosity to stop the further penetration of chlorides and CO2 from its surrounding environment, and thus provide a permanent solution for concrete repair suffered from carbonation and chloride attack.

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**NBR: 294965** **ACRONYM: PRIMA-ERA** **EC FUND: 498621**

**DG:** RTD **Call: FP7-INCO-2011-6** **Thema:** INCO.2011-6.1

**Title:** Promoting and Improving Azerbaijan Research Collaboration with European Research Area

**Abstract:** The PRIMA-ERA project is designed to reinforce research collaboration between the Institute of Physics, Azerbaijan National Academy of Sciences (IPA) and research centres in the European Research Area. The IPA is a leading organization on scientific research, knowledge transfer and graduate education in physics in Azerbaijan. PRIMA-ERA will facilitate the collaboration of the IPA with research centres in EU member and associate countries and reinforce its engagement in the FP7 projects in research topics covered by such thematic priorities as energy and nanotechnologies. The primary objectives of the project are: - to increase IPA capacities and preparedness for collaboration in the FP7

through twinning and networking, development of joint research plans and training modules and trainings; - to increase visibility of IPA for international scientific community and other stakeholders through dissemination of scientific information and promotional activities; - to ensure the compliance of the IPA's research activities with socio-economic needs of the country and regionally and provide better career opportunities for young scientists through encouragement innovative approaches and development of research strategy. The project consortium between the IPA, CNRS Institut de Recherche et Development sur l'Energie Photovoltaique, CNRS-IRDEP (France) and TUBITAK – Marmara Research Centre, TUBITAK - MAM (Turkey), has been established to effectively fulfill the project's objectives. The PRIMA-ERA will comply with the EU strategies for an "open ERA" as mentioned in the EC Communication for International S&T Cooperation by providing mobility and access to research facilities between the centres with similar research interests. The project actions will be in coherence with the concept of the "mutual interests of the EC and the ENP partner countries" as stated in the mentioned Communication.

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**NBR: 295000** **ACRONYM: NAS-ERA** **EC FUND: 498394**

**DG:** RTD **Call: FP7-INCO-2011-6** **Thema:** INCO.2011-6.2

**Title:** Reinforcing Nanostructured material research cooperation between the UnitÃ© de DÃ©veloppement de la Technologie du Silicium (UDTS) and the European Research Area (ERA)

**Abstract:** The overall aim of the NaS-ERA project is to integrate the Unité de Développement de la Technologie du Silicium (UDTS) into the European Research Area (ERA), by developing cooperation with European research and innovation organisations in its 3 strongest research topics: i) Production of functional nanostructures, ii) Development of new detection methods, and iii) Design and development of new sensors. UDTS is a major R&D entity under the Ministry of Higher Education and Scientific Research of Algeria with a high potential for integration into ERA. Since its establishment in 1988, UDTS' main mission was to conduct scientific research activities and technological innovation in silicon material and semiconductor science and technology: photovoltaic, functional nanostructures, measurement and detection systems, optoelectronics, photonics, etc. In 2010, UDTS has evolved into a National Research Centre and is planned to set up, with the support of local universities and research entities, a technology Cluster in material science with a sufficient research capabilities to reach International norms and standards. The NaS-ERA project will build upon UDTS's existing strengths as a high-quality research institution via capacity building activities with the following 4 excellent European research and innovation organisations: 1) CNRS – Laboratoire de Physique de la Matière Condensée, 2) National Institute of Metrological Research, 3) Fraunhofer Institute for Mechanics of Materials, and 4) Intelligentsia Consultants. The capacity building activities will involve twinning and training development for UDTS researchers

focused on the Production of functional nanostructures, the Development of new detection methods, the Design and development of new sensors, and the FP7 programme. Also, it will involve dissemination and strategy development to support the UDTS organisation.

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**NBR: 295043** **ACRONYM: BELERA** **EC FUND: 499696**

**DG:** RTD **Call: FP7-INCO-2011-6** **Thema:** INCO.2011-6.1

**Title:** Reinforcing carbon nanotubes and photonics research cooperation between the Belarusian State University of Informatics and Radioelectronics and the European Research Area

**Abstract:** The overall aim of the BELERA project is to integrate the Belarusian State University of Informatics and Radioelectronics (BSUIR) into ERA by reinforcing BSUIR's research cooperation capacities and twinning with European research and innovation organisations in the following CNT and photonics related research topics: Magnetic properties of CNT; Emission properties of CNT based cold cathodes; and Nanostructured materials for novel photonic devices. These are research topics highly relevant to the FP7 NMP and FP7 ICT. BSUIR is the leading academic institution in Belarus for research in micro- and nanoelectronics; new perspective materials; beam-technologies and technics; and radio engineering devices and systems. Its researchers have published numerous research papers in international, peer-reviewed journals during the past 5 years (e.g. Journal of Applied Physics). The BELERA project will build upon BSUIR's existing strengths as a high-quality research institution via twinning and capacity building activities with the following 4 excellent European research and innovation organisations: Institut d'Électronique du Solide et des Systèmes Strasbourg, Bergische Universität Wuppertal, Universidad Politécnica de Valencia – Nanophotonics Technology Centre, and Innoveo Consulting. The capacity building activities will involve knowledge exchange, setting up joint experiments, and training development for BSUIR's researchers focused on the 3 research topics and the FP7 programme. Also, it will involve mapping and promotion of nanoelectronics and nanophotonics organisations across Belarus, and strategy development to support BSUIR and foundation of the Belarusian Nanoelectronics and Nanophotonics Technology Platform. The BELERA project will be overseen by a steering committee involving the consortium partners plus representatives of the Ministry of Education, State Committee on Science and Technology, National Academy of Sciences, and State Microelectronics Companies Integral and Planar.

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**NBR: 295089** **ACRONYM: EUJO-LIMMS** **EC FUND: 1999982**

**DG:** RTD **Call: FP7-INCO-2011-7** **Thema:** INCO.2011-7.4

**Title:** EUrope-Japan opening of LIMMS

**Abstract:** EUJO-LIMMS aims to reinforce research collaboration between Europe and Japan to tackle new challenges in micro and nano technologies. The strategy consists in opening the activity of an international laboratory, the Laboratory for Integrated Micro Mechatronic Systems (LIMMS), located in Tokyo, to European partners. The LIMMS is a research unit between CNRS and the Institute of Industrial Sciences of the University of Tokyo (UT-IIS). More than 100 French researchers have stayed at LIMMS and have combined their scientific and technological expertise with their Japanese hosts. EUJO-LIMMS will open LIMMS structure and hosting capacities to researchers from three European partners. To guaranty a smooth evolution, the partners having already networking activities with both CNRS and UT agreed to join the program. These partners are EPFL in Switzerland, IMTEK in Germany and VTT in Finland. The scientific challenge of EUJO-LIMMS is to push the frontiers of micro and nano systems technology in capitalising the complementary expertise of UT and European partners. The hosted European researchers will develop joint projects for new applications in flexible electronics, optics, nanotechnology, molecular and cellular bio-engineering. At mid-project a call will be organised to expend the collaboration to European researchers from other Member States or Associated Countries. The proposals will be stimulated by an open workshop in Europe and the new partner will be selected by the EUJO-LIMMS consortium. The opening of the institutional arrangement of LIMMS/CNRS-UT to additional partners will be studied on the basis of the experience acquired by UT and CNRS, and on the discussions with the consortium. The EUJO-LIMMS targets significant enhancement of EU-Japan's collaborations, as the scientific topic addresses micro- and nanotechnologies, a blooming area where many applications are foreseen. Japan is ahead in that field and is a country where the Technology is a Science.

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**NBR: 295128** **ACRONYM: NANOBRIDGES** **EC FUND: 491600**

**DG:** REA **Call: FP7-PEOPLE-2011-IRSES** **Thema:** FP7-PEOPLE-2011-IRSES

**Title:** Building bridges between specialists on computational and empirical risk assessment of engineered nanomaterials

**Abstract:** The project is aimed at creating a worldwide network of research partnerships, including various types of research organizations from EU and third countries, with different profiles (computational and empirical risk assessors), focused on the development of new tools for computational risk assessment of engineered nanoparticles (NPs). The mobility plan, supported by the electronic communication tools will create a platform for sharing knowledge and overcoming the fragmentation of scientific efforts in this novel and high priority research field. This is important, because extensively developing

nanotechnology might create a significant risk for humans and the environment. We are going to build 3 metaphoric bridges across the problems limiting risk assessment for NPs: Bridge I: Collaboration between developers of computational and empirical methods for risk assessment. Bridge II: Exchanging ideas developed simultaneously by different groups of similar profiles (e.g., computational – computational). Bridge III: Coordination of regulatory efforts worldwide in the area of nanorisk assessment.

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**NBR: 295145** **ACRONYM: NANOMAR** **EC FUND: 138100**

**DG:** REA **Call: FP7-PEOPLE-2011-IRSES** **Thema:** FP7-PEOPLE-2011-IRSES

**Title:** NANOCONTAINER-BASED ACTIVE COATINGS FOR MARITIME APPLICATIONS

**Abstract:** NANOMAR project aims at establishing long-lasting scientific collaboration network between European research institutions and scientists from two BRIC countries, namely Brasil and Russian Federation. The collaboration will be established on the basis of synergistic combination of the complementary expertises targeting in development of novel “smart” sustainable materials for offshore applications. The collaborative network joints together groups working on development of new functional nanocontainers, novel protective coatings as well as teams holding recognised expertise on the characterization of the anticorrosion coatings. The main scientific objective of the proposal is development of a new generation of “smart” bifunctional coatings that combine the self-healing anticorrosion ability with antifouling properties for offshore applications such as oil-mining platforms and windmill farms. The main scientific approach on which this project is based is the controlled release of the active species (corrosion inhibitor and biocide agent, respectively) from nanostructured receptacles (nanocontainers) in damaged zones of the coating. The separated specific activities are already ongoing in the individual involved institutions. Therefore the high financial investments are not requested. The extensive exchange of knowledge and expertise on the mutual benefit basis seems to be the most appropriate tool for implementation of the planned objectives.

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**NBR: 295156** **ACRONYM: OFFGAS** **EC FUND: 252000**

**DG:** REA **Call: FP7-PEOPLE-2011-IRSES** **Thema:** FP7-PEOPLE-2011-IRSES

**Title:** OFFshore GAs Separation

**Abstract:** Gas separations on offshore platforms are of increasing importance for the purification of natural gas and for the separation of CO2 used in enhanced oil recovery (EOR). Separations based on nanoporous materials, adsorption and membranes will be the

method of choice for applications on floating platforms, where liquid solvents cannot be used due to problems arising from the tilting and rolling of the moving platforms. Developing effective materials and efficient process technologies for gas separations at high pressure plays a key role in the economic exploitation of offshore resources. Both Brazil and the EU have large vested interests in this field: Brazil has important offshore gas reservoirs situated where the seabed is too deep for a fixed platform, while EOR will be widely exploited in the North Sea. The proposed project will involve exchanges among three universities that are already conducting world-class research on materials and adsorption and membrane processes, thereby bringing together expertise on different aspects of the gas separation technology. The exchange of researchers will reinforce the links already established between the EU and Brazil, leading to further collaboration and joint proposals. In particular, the synergy between the research groups in the three institutions will give rise to technological breakthroughs that will also have applications in other fields. The project includes exchange of both early stage and experienced researchers to exploit fully the knowledge transfer for a total of 120 person-months exchanges. 23 experienced researchers will be seconded to a different institution. Early career researchers will spend a longer period of time in the partner institution in order to broaden their research knowledge and to experience a different social and cultural environment. The project will involve 12 PhD students, who will have the opportunity to perform part of their research abroad in one of the partner institutes.

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**NBR: 295160** **ACRONYM: CAGEDRUGS** **EC FUND: 235600**

**DG:** REA **Call: FP7-PEOPLE-2011-IRSES** **Thema:** FP7-PEOPLE-2011-IRSES

**Title:** Design and elaboration of novel topological drugs based on cage compounds

**Abstract:** The proposal presented here brings together five research centers from 4 countries: Poland, Germany, Ukraine and Russia and is devoted to the development of nanosized metal clathrochelate cage compounds based on a template synthesis approach, their physico-chemical characterization and their use in development of novel materials for biomedical applications. The partners involved have a recognized history of collaboration at a project level and have worked together in a series of joint research projects in the past. The establishment of this joint exchange programme will promote and strengthen the complementarity of the participants and will stimulate the teams' cooperation, thus forming an excellent center of synergy in research, innovation and technology in the area of nanomaterials for biomedical purposes. Each of the labs involved in this collaboration has a unique, yet complementary expertise. By visiting different labs graduate students and early career scientists will significantly improved their skills and expertise. They will also benefit tremendously from visits of senior scientists in partner labs. The proposed academic exchange aims to establish and support multilateral transfer of knowledge and expertise among several European and

international research teams. Transfer of knowledge between the partners will also include regular seminars and workshops delivered by the seconded staff .

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**NBR: 295172** **ACRONYM: TEMM1P** **EC FUND: 516600**

**DG:** REA **Call: FP7-PEOPLE-2011-IRSES** **Thema:** FP7-PEOPLE-2011-IRSES

**Title:** Computer simulations of thermally excited molecules and materials by first principles

**Abstract:** With the rapid development of computational sciences and of high-performance computing, first principles computer simulations have become a standard for the simulation of processes in physics, chemistry, biology and materials science. Moreover, the quality of first principles methods, most of all of density-functional theory, reached recently that of experiments, which allows the prediction of new forms of condensed matter, including novel molecules and nanomaterials with specially designed building units. However, these simulations refer to the electronic ground state, while in reality and experiment the materials are exposed to elevated temperatures, where also the electronic structure should be considered to be thermally excited. We will develop, implement and validate methods to simulate processes at thermally elevated temperatures. Our target applications are the formation of fullerenes and endohedral fullerenes in arc discharge plasma, thermolysis of ammonia boranes, chemical reactions of oil sands cracking at high temperature and pressure, ion diffusion in clay-mineral nanotubes, and mass spectrometer chemistry including the formation of new molecules with untypical bonding properties and the chemical reaction of methane with late transition metal and rare earth ions, a hopeful way to produce molecular hydrogen from natural gas. All applications have in common that they occur at high temperature and partially high pressure, and hence require similar computational methods. With this proposal we would like to initiate a Transfer of Knowledge scheme where we will create synergies in developing these methods, implement them for their use in latest supercomputer facilities, and have well-trained personnel to be able to operate them in the individual workgroups. The Exchange Programme includes long-term stays of graduate students (ESR) as well as shorter-term stays of research staff (ER) and professors.

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**NBR: 295180** **ACRONYM: MAGNONMAG** **EC FUND: 524700**

**DG:** REA **Call: FP7-PEOPLE-2011-IRSES** **Thema:** FP7-PEOPLE-2011-IRSES

**Title:** Magnetic order induced in nonmagnetic solids

**Abstract:** Our aim is to establish long lasting collaboration in the frames of a research program the goal of which is to develop novel methods of control and manipulation of the magnetic degree of freedom in nominally nonmagnetic materials, in view of their potential for nanotechnology and nanoscience. The principal objective of the MagNonMag project is to bring together leading research groups in the field of nanomagnetism and establish an interdisciplinary training ground for both early stage researchers and experienced researches, enhancing the information partnership between theoretical and experimental research groups working in physics, chemistry, material science, and nanotechnology. The project is focused on nanomagnetism – magnetism shown by some materials on a nanoscale even if magnetically inert in the bulk – a novel physical effect with a potential for the emerging spintronics technology. The MagNonMag project will study the possibility to control magnetism by various means such as introducing sp impurities and defects in nonmagnetic materials through ion bombardment, fluorination, and transmutation doping. The objects under investigation are IV group elements with the emphasis on graphite/graphene systems. Induced magnetism phenomena studied in this project have a potential to provide new effects and functionalities which are highly desirable and of great technological and economic relevance. The synergy of the scientific strength of the Russian Academy Institutes with the technological and analytical potential in the research groups in EU (Sweden, Spain, Italy) and Australia provides a valuable opportunity to study and understand novel phenomenon of induced nanomagnetism which is promising for nanotechnology applications.

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**NBR: 295182** **ACRONYM: PHANTASY** **EC FUND: 146600**

**DG:** REA **Call: FP7-PEOPLE-2011-IRSES** **Thema:** FP7-PEOPLE-2011-IRSES

**Title:** Photonic Applications of Nanoparticle Assemblies and Systems

**Abstract:** The proposal covers the planned actions of a consortium consisting of five members. These are all research organisations, three of which are EU -based with one other being based in Russia and the final organisation being based in Japan. The consortium intends to establish a research programme which is aimed at the production of advanced structures that include colloidal assemblies, nanoparticles, oxides and metals in order to gain a fundamental understanding of their properties with the aim of using them for manipulation of light on the nanoscale. The planned work is described in detail in the form of three work packages (WP). The first addresses key roadblocks in the exploitation of nanophotonic materials and is entitled 'From ‘imperfect’ colloidal crystals to functional engineered nanophotonic architectures'. The second is entitled 'Metallodielectric colloidal crystal platform for plasmonic circuits and optical transformations ' and addressing key issues associated with novel device operation. The third is devoted to the idea of organising two Summer Schools, one in Europe and one in Japan, thus disseminating the most up-to-date knowledge available. The School(s)

intend to cover the area of the interaction between light and a range of optically-active materials under differing conditions, while they will also focus on possible applications of these materials.

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**NBR: 295190** **ACRONYM: NANOMAG** **EC FUND: 506100**

**DG:** REA **Call: FP7-PEOPLE-2011-IRSES** **Thema:** FP7-PEOPLE-2011-IRSES

**Title:** Magnetic Nanoparticles and Thin Films for Spintronic Applications and High Performance Permanent Magnets

**Abstract:** This proposal aims to establish a research network in the Area of magnetic nanostructured materials for novel spintronic, novel permanent magnets and biomedical applications, through collaboration and exchange of staff among six Prominent European Union Universities and Research Institutes, with top-class International laboratories, three from USA and one from Korea. The scientific objectives of the project are: (1) To synthesize and study in detail the electronic, magnetic and magnetotransport properties of Rare Earth/Transition Metal oxides in bulk and thin films. (2) To functionalize Thin Films and fabricate/test prototype spintronic devices. (3) To fabricate Hybrids of Transition Metal Oxide thin film nanostructures and nanodevices with Molecule/Organic-based-Magnets. (4) To develop cutting edge basic research into the intrinsic properties of hard magnetic nanoparticles. (5) To develop new technologies for nanoparticle production using novel fabrication techniques. (6) To use novel processing techniques for the consolidation of nanoparticles into Permanent Magnet compacts, with a view to realising energy products in excess of 800 KJ/m3. (7) To functionalize and characterize Fe3O4/Fe2O3 nanoparticle colloids in various matrices for biomedical applications. (8) To test in vitro the efficacy of the produced nanocolloids for Magnetic Hyperthermia and Magnetic Resonance Imaging Contrast (as Contrast Agents). The project is based on existing collaborations between partners, together with shared PhD programs. The establishment of this staff exchange program is expected to strengthen the complementarity of the participants involved and to become a Worldwide-extending Virtual Center of Excellence in the Area of Nanostructured Magnetic Materials.

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**NBR: 295196** **ACRONYM: DMH** **EC FUND: 47500**

**DG:** REA **Call: FP7-PEOPLE-2011-IRSES** **Thema:** FP7-PEOPLE-2011-IRSES

**Title:** Nonlinear dynamic hysteresis of nanomagnetic particles with application to data storage and medical hyperthermia

**Abstract:** The subject of the project is the magnetodynamics of single-domain ferromagnetic nanoparticles driven by strong ac magnetic fields. The phenomenon of prime interest here is dynamic magnetic hysteresis (DMH) . The main important applications of DMH are (i) magnetic moment switching (under pulsed fields) in magnetic data storage and (ii) heat generation in magnetically induced hyperthermia (medical as well as other applications). Nowdays local magnetic hyperthermia is one of the most promising approaches in addition to chemical and radiological methods for cancer treatment. Unfortunately, the progress is hampered by the lack of reliable understanding of the laws governing the interplay between internal (magnetic relaxation) and external (viscous dissipation due to mechanical rotation) losses and their joint effect on heat generation. There also exists a "no-man land" between two limiting frameworks: (i) natural (intrinsic) magnetic resonance where the magnetic moment precession is due to the internal field and (ii) the standard (Zeeman) magnetic resonance where the main factor in the precession is dominated by a strong external field while the internal field is merely a perturbation. In the second case, substantial increase in the absorption can be achieved which is important for hyperthermia. We are going to study magnetodynamics and energy absorption in solid and liquid suspensions of magnetic nanoparticles by developing analytical and numerical techniques for treating effects of dissipation to the surrounding heat bath in DMH. The results obtained from analytical and numerical solutions of the Gilbert-Landau-LIfshitz equation augmented by a random field term will be compared with available experimental observations.

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**NBR: 295208** **ACRONYM: CARBONNASA** **EC FUND: 233100**

**DG:** REA **Call: FP7-PEOPLE-2011-IRSES** **Thema:** FP7-PEOPLE-2011-IRSES

**Title:** Carbon-based Nanomaterials and Nanostructures for Advanced Sensing Applications

**Abstract:** We are proposing a 4-year program of knowledge transfer and networking between Aston University, UK (Aston), the University of Aveiro, Portugal (UAvr), University of Rochester, USA (URoc), Old Dominion University, USA (ODU), National Institute for Materials Science, Japan (NIMS), Chinese Academy of Science, China (CAS), and Changshu Institute of Technology, China (CIT). The objective of the proposed joint exchange programme is to establish long-term stable research cooperation between the partners with complimentary expertise and knowledge. The project objectives and challenges present a balanced mix between industrial application focused knowledge transfer and development and more far-looking studies for potentially ground-breaking applications of using carbon-based nanomaterials and nanostructures for advanced sensing applications (CarbonNASA).

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**NBR: 295216** **ACRONYM: WIROX** **EC FUND: 317100**

**DG:** REA **Call: FP7-PEOPLE-2011-IRSES** **Thema:** FP7-PEOPLE-2011-IRSES

**Title:** Oxide Nanostructures for Wireless Chemical Sensing

**Abstract:** Wireless sensor nodes (the so called ”Smart Dust”) are autonomous devices incorporating sensing, power, computation, and communication into one system. The incorporation of electrical gas sensors in motes is a scientific challenge which has not been solved yet. The objective of the project is to build up an international partnership to tackle these scientific challenge developing self-powered autonomous nano-scale chemical sensors which harvest energy from the environment. The objective will be pursued by packing together scientists from top level institutions and training young researchers to the twofold task of developing self heated nanowire based chemical sensors and Quantum Dots Solar Cells and integrate the latter for powering the first in a mote. Long lasting collaborations will be developed through exchange of people and realization of different research activities. Primary application will be Energy-efficient Buildings (EeB), which are already some of the largest and most prevalent deployments of “sensor networks” in the world, although they are not typically recognized as such. Wireless gas sensing of air quality could strongly increase the performance of HVAC systems (among NMP 2012 topics).

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**NBR: 295218** **ACRONYM: HEPTAG EXCHANGE** **EC FUND: 105000**

**DG:** REA **Call: FP7-PEOPLE-2011-IRSES** **Thema:** FP7-PEOPLE-2011-IRSES

**Title:** Targeted delivery for liver cancer treatment

**Abstract:** The Liver cancer drugs market is expected to become an active ground for competition in the future. According to recent market analysis, the liver cancer market in 2009 was valued at approximately US$0.4bn, indicating a growth rate of 27.1% between 2001 and 2009. It is estimated that the liver cancer market in 2017 will be $1.2bn, with a compound annual growth rate (CAGR) of 15.5% between 2009 and 2017. The growth of the liver cancer market is driven by the growth of the aging population, the greater access to medical care in the emerging new economic regions like China, and the innovative therapies such as targeted therapy In this project target delivery for liver cancer treatment using biomarker functionalized vehicles is planned. Due to the lack of the needed expertise in one centre or region a consortium is formed. The consortium focuses on the development of nano-vehicle materials for targeted delivery and the relevant practices towards in vitro level of understanding of the effect of the delivery systems on cancer cell treatment. In this consortium, four work packages (WPs) are formed, namely, WP-1: Pharmaceutical materials; WP-2: Formulations; WP-3: Cancer cell imaging; and WP-4: Cancer cell treatment. To support this consortium, biomarkers will be selected from the available products in terms of the functionality of the

biomarkers. The consortium comprises 4 partners (2 from EU, 1 from China, and 1 from USA), who are centers of excellence in their unique areas of expertise: Sichuan for preparation of functional polymersomes, Navarra for drug formulations, FIU for cancer cell imaging, and UoW for cancer cell treatment. Most importantly is the development of novel liver cancer therapy, fostering strategic collaborations between EU and China and knowledge transfer and dissemination through staff mobility.

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**NBR: 295224** **ACRONYM: BIOAPPRONFS WETT** **EC FUND: 220500**

**DG:** REA **Call: FP7-PEOPLE-2011-IRSES** **Thema:** FP7-PEOPLE-2011-IRSES

**Title:** Biomimetic Approaches of Natural Functional Surfaces with hierarchical micro & nano structure and the extreme Wettability

**Abstract:** Proposal Full title: Biomimetic Approaches of Natural Functional Surfaces with hierarchical micro & nano structure and the extreme Wettability (Acronym: BioApproNFS Wett) Abstract: In the natural world, plants and animals have evolved over time to best adapt to the environment. They interact very effectively with the surrounding environment by exchanging energies and mass flow across their cuticles making use of specific micro structures and functions to achieve the perfect energy balance. The proposed international research staff exchange programme of "BioApproNFS Wett" brings together five leading universities from four different countries to collaborate in the research area of biomimetic approaches of natural functional surfaces and the extreme wettability. The aim of the proposed programme is to facilitate research staff exchange between the leading institutions in biomimetics so that complementary and synergistic skills can be acquired as per the needs and skills offered by the respective partners. These can then be exploited in the future through initiatives as part of the international joint laboratory that will be established through this project. The programme will have major benefits for early staged researchers from high education institutes and also the industrial companies from both Europe and China. Through research collaboration and staff exchanges, the state-of-the-art technologies of studying biomimetics (or bionics), such as micro scaled fabrication, functional nanoparticle coating, hierarchical micro & nano structure, and surface wettability will be studied and/or applied. Major programmes of the research staff exchanges include research visits, training for early staged researchers, and organising regular open research seminars, workshops and conferences. The dissemination and exploitation will be based on joint research publications and open seminars where the industrial community will be actively encouraged to attend.

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**NBR: 295241** **ACRONYM: FANCEE** **EC FUND: 127300**

**DG:** REA **Call: FP7-PEOPLE-2011-IRSES** **Thema:** FP7-PEOPLE-2011-IRSES

**Title:** Fundamentals and Applications of Nano-Carbon Electron Emitters

**Abstract:** Development of efficient electron sources is crucial for a wide range of applications including integrated vacuum microelectronics, MEMS, bright flat panel displays, energy conversion devices, and compact microwave amplifiers. In the search for new cathodes capable to produce a strong electron flux at low energy consumption, carbon materials possessing extraordinary field emission properties have been attracted a lot of attention. Control of the morphology and electron properties of nanocarbon species opens tremendous opportunities in the development of advanced electron sources.. In the framework of the FANCEE Programme we will combine advanced materials synthesis, state of the art electron microscopy, and a range of characterization techniques to develop fundamentals and applications of the nanocarbon materials for electron emission. The research objectives of the FANCEE are (i) to reveal fundamental mechanisms of the field, thermionic and laser assisted electron emission from the nanostructured carbon materials, (ii) to establish relationship between structural and emission properties and create nanocarbon materials that enable enhanced emission, and (iii) to optimize the material properties and create advanced carbon cathodes for specific applications including cathodoluminescent light sources, X-ray tubes, electron guns for vacuum electronic devices. We anticipate that theoretical and experimental results of FANCEE will provide new insights in the fundamental properties and application potential of nanocarbon materials in electronics. New functionalities arising from the nanostructuring of carbon cathodes will enable development of compact sources of ultra dense electron bunches of ultrashort duration. FANCEE will reinforce the existing and create new cooperation links between the Partners through a coordinated joint programme in fabrication, investigation and applications of nanocarbon materials.

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**NBR: 295254** **ACRONYM: FUNCTIONAL** **EC FUND: 159600**

**DG:** REA **Call: FP7-PEOPLE-2011-IRSES** **Thema:** FP7-PEOPLE-2011-IRSES

**Title:** Strengthen International Research Collaborations on the Development of Functional Surfaces between the EU, Brazil and Mexico

**Abstract:** The FUNCTIONAL project is aimed to achieve the strengthening cooperation between the European Union with third countries such as Brazil and Mexico in order to transfer knowledge in the development of functional and high-performance nanostructured surfaces. Therefore, the networking RTD activities among the four partners involved will strengthen the International dimension of the European Research Area by promoting the secondments of researchers either by receiving incoming staff members from Brazil and Mexico or by sending outgoing staff members from Spain and Germany. The main

objectives of the joint exchange programme are: 1) Strengthening collaboration between European R&D centres of excellence and other organizations belonging to third countries. 2) Development of new research capacities in knowledge areas of large potential impact. 3) Maintaining sustainable research cooperation between EU countries and Brazil and Mexico through an exchange system between the partners not only during the project but also beyond it, promoting the creation of active and formal partnerships between the partners. The programme of exchange is focused on developing high-performance and functional nanostructured coatings able to withstand wear and corrosion hard conditions present during life-in service of many components for several industries. New advanced techniques (laser and friction stir based techniques) will be used in order to create this functional surface.

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**NBR: 295260** **ACRONYM: ECONANOSORB** **EC FUND: 378100**

**DG:** REA **Call: FP7-PEOPLE-2011-IRSES** **Thema:** FP7-PEOPLE-2011-IRSES

**Title:** Ecological application of nanosorbents on the base of natural and synthetic ionites and carbons

**Abstract:** The proposed research project brings together European universities and research centres from Spain, Italy and Germany and three participant institutions from Russian Federation and Ukraine. It builds on existing international projects under the Seventh Framework programme and will enhance the already active collaboration in the field of environmental protection. The main aim of the proposal is to create conditions for mutual research among similarly orientated European research institutions and overcome existing gap between research institution and wood processing industry. The main objectives are: supporting and improving human and research potential, expanding research cooperation in European research area, spreading the output of the research on the both European and international level. Some of the project outputs are exchanging know-how with experienced research entities in Europe, Russia and Ukraine organizing conferences, creating strategic research plan for forest products based sector, improving tools for research results dissemination and online service for forest based industry sector. Increasing production of wood processing industry within Europe, with limited resources of renewable wood raw material, creates needs for more efficient, effective and knowledge based utilization of this raw material. The project consists of the following workpackage Preparation, characterization of nanomaterials from natural and synthetic ionits for adsorption of industrial toxicants; Preparation, characterization and application of combined adsorbents on the base of carbon nanomaterials; Application of nanosorbents for wastewaters and air purification and utilization in nanocomposite materials; Development of a sensor of industrial toxicants and biomedical devices on the base of nanomaterials; Risk and impact assessment related to production and application of nanomaterials in the wood industry as well as Project coordination.

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**NBR: 295262** **ACRONYM: VAIKUTUS** **EC FUND: 735800**

**DG:** REA **Call: FP7-PEOPLE-2011-IRSES** **Thema:** FP7-PEOPLE-2011-IRSES

**Title:** Novel inorgano-bioorganic nanocomposites for biomedical and engineering applications

**Abstract:** The principal objective of the present Project is to establish a long-lasting collaboration, to provide a possibility for transfer of knowledge, to enable exchanges of research personnel, and to create an intercontinental network in the area of hybrid inorgano-bioorganic nanocomposites for biomedical and engineering applications. Realization of the Project will lead to the development of novel nanobiocomposites, which are based on natural components specific for particular regions of Brazil and South Africa. The expertise of the consortium partners is mutually complementary, it encompasses synthesis of the nanocomposite precursors (FI), their modification and improvement of synthetic approaches to hybrid nanocomposites (UA), isolation and characterization of natural active compounds and fibres of plant origin (BR2, BR1, ZA) that are coupled with the development of advanced nanophases and hybrid nanocomposites (FI, IT1, IT2, BR1). Main scientific goal of Project consists in the development of knowledge-based high-added value inorgano-bioorganic nanocomposites, natural and nature identical materials, drug delivery vectors, pharmaceutically active compounds, pharmaceutical and cosmetic formulas through valorisation of regional natural resources and scientific expertise. Innovative nanocomposites and their novel components will be characterized using up-to-date facilities available at all partner organizations for comprehensive physico-chemical, mechanical, spectroscopic, and microscopic studies at the nano-scale; followed by assessment of their anti-cancer, anti-parasite, insecticide and antimicrobial performance in in-vitro (BR2, ZA) and in-vivo tests (ZA). Ethical issues of the research will be duly addressed. Results of the Project will strengthen the scientific potential of ERA, will contribute to the sustainable development in participating countries and promote regional development of the Partner Countries.

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**NBR: 295273** **ACRONYM: NANEL** **EC FUND: 250800**

**DG:** REA **Call: FP7-PEOPLE-2011-IRSES** **Thema:** FP7-PEOPLE-2011-IRSES

**Title:** Functional ordered NANomaterials via ELectrochemical routes in non-aqueous electrolytes

**Abstract:** The NANEL joint exchange project aims to establish long-lasting research cooperation between Portuguese, Bulgarian, Belgian, Belarusian and Russian scientists in the field of electrochemical synthesis of advanced nanostructured materials. The collaborative

consortium joins together a critical mass of the expertise available in the involved groups. The partners bring the complementary experiences and experimental facilities which are essential for effective development and testing of the nanomaterials for to be applied in sensors and photovoltaics. Mutually beneficial transfer of knowledge will be implemented through an intensive exchange program between six partner organizations. The main technical objective of the project is development of novel functional nanomaterials for sensors and solar cell applications on the basis of ordered nanoporous anodic oxides. The main scientific novelty of the project is functionalization of the porous anodic oxides, such as alumina or titania based ones, via electrochemical or electrophoretic ways using non-aqueous electrolytes. Ionic liquids and molten salts will be used as prospective candidates for the electrolytes. The electrochemical synthesis of nanomaterials has several important advantages because of relatively low costs and fine control of the process parameters. The suggested approach will confer creation of new ordered functional nanomaterials via electrochemical routes which are not possible in water-based electrolytes. Use of non-aqueous solution confers significant advantages for specific materials which are not stable in presence of water or can not be electrodeposited because of the relatively narrow electrochemical window of water.

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**NBR: 295322** **ACRONYM: VINAT** **EC FUND: 1484300**

**DG:** RTD **Call: FP7-NMP-2011-EU-RUSSIA** **Thema:** NMP.2011.1.4-5

**Title:** THEORETICAL ANALYSIS, DESIGN AND VIRTUAL TESTING OF BIOCOMPATIBILITY AND MECHANICAL PROPERTIES OF TITANIUM-BASED NANOMATERIALS

**Abstract:** The goal of this project is to develop multiscale theoretical models of biocompatible metallic nanomaterials and apply them for the analysis, design and optimization of the materials. Two groups of titanium based nanomaterials are considered (while the methods developed should be applicable to other metallic materials as well): nanostructured commercially pure titanium and shape memory NiTi alloy. The multiscale model of nanostructured titanium (nTi) includes atomistic molecular dynamics (MD) discrete dislocation dynamic model (DDD) of the nucleation, interaction and movement of dislocations, crystal plasticity models mechanical behavior of Ti nano-grains, coupled texture and substructure evolution model for severe plastic deformation of polycrystalline Ti, micromechanical analysis of the grain sizes and microstructures on the mechanical properties. The atomistic and micromechechanical modeling of martensitic transformation (or reorientation) lattice strain of NiTi alloys is carried out. The biocompatibility of these two groups of materials (MD modeling of the interactions between metallic nanoparticles and biological molecules) is studied theoretically. The theoretical studies and recommendations are validated experimentally and in practice.

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**NBR: 295355** **ACRONYM: COMPNANOCOMP** **EC FUND: 1491798**

**DG:** RTD **Call: FP7-NMP-2011-EU-RUSSIA** **Thema:** NMP.2011.1.4-5

**Title:** Multiscale computational approach to the design of polymer-matrix nanocomposites.

**Abstract:** This project aims at the development of multiscale simulation methodology and software for predicting the morphology (spatial distribution and state of aggregation of nanoparticles), thermal (glass temperature), mechanical (viscoelastic storage and loss moduli, plasticity, fracture toughness and compression strength), electrical and optical properties of soft and hard polymer matrix nanocomposites from the atomic-level characteristics of their constituent nanoparticles and macromolecules and from the processing conditions used in their preparation. The hierarchical simulation methodology and software to be developed will be validated against two main categories of systems: silica-filled natural and synthetic rubbers and carbon nanotube filled thermoset resins. The novel ground-breaking modelling methodology should significantly improve the reliable design and processability of nanocomposites contributing to the EU Grand Challenges for reduction of CO2 emission, energy savings by light-weight high-strength nanocomposites, mobility and improved living environment. The successful outcome of the project will constitute an important advance in the state of the art and will have immediate industrial, economic and environmental impact. The multiscale simulation methodology of EU-COMPNANOCOMP focuses on soft nanocomposites (thermoplastics) whereas the complementary RU-COMPNANOCOMP focuses on glassy nanocomposites (thermosets)(grey in proposal). RU-COMPNANOCOMP is completed with EU partners for experimental validation of the multiscale modelling codes. Both EU and RU consortia work on the development of algorithms to be integrated in a multiscale modelling software package for further commercialization. A total of 213.5 man months completed with 26 man months from own resources is proposed with a project duration of 36 months appropriate for achieving the challenging objectives. EU-COMPNANOCOMP has a total cost of 2.3 million € with EC funding of 1.5 million € requested.

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**NBR: 296679** **ACRONYM: MANAQA** **EC FUND: 2775302**

**DG:** CNECT **Call: FP7-ICT-2011-C** **Thema:** ICT-2011.9.1

**Title:** Magnetic Nano Actuators for Quantitative Analysis

**Abstract:** The MANAQA project is a multidisciplinary approach that combines innovative technologies emerging from different fields including nanotechnology, biochemistry, and nanorobotics. The strategy that will be exploited is based on a recently developed 5-DOF magnetic manipulation system combined with an atomic force microscope (AFM)

system and functionalized magnetic nanowires. The fusion of these technologies has the potential to revolutionize many aspects of single-molecule manipulation and measurement. Information related to the structure and physical properties of macromolecules (i.e., proteins, polynucleotides) will be obtained. In a typical experiment, a molecule will be regiospecifically attached between a magnetic nanowire and the tip of an AFM cantilever. The extremely small footprint of the magnetic nanowire and the accuracy of a five degree-of-freedom magnetic manipulation system will allow high-resolution and stable force control on the molecule. The mechanical response of the molecule will be monitored using the AFM cantilever. Moreover, the system will be capable of measuring the electrical parameters of the nanowire-molecule hybrid. The success of this proposal will lead to long time-scale, low drift experiments that will provide invaluable insights on mechanisms governing conformational changes in single macromolecules by elucidating protein folding/unfolding/refolding trajectories at a low-force regime. This will contribute to the long-term vision of MANAQA of establishing a biomolecular measurement platform with extended capabilities. MANAQA opens new avenues in disciplines such as biochemistry, pharmacy, and biomedicine. The development of new miniaturized electronic devices within the scope of MANAQA project with single chemical entities integrated as their components will revolutionize the field of Information and Communication Technologies (ICT).

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**NBR: 297401** **ACRONYM: STREAKMS** **EC FUND: 150000**

**DG:** ERCEA **Call: ERC-2011-PoC** **Thema:** ERC-OA-2011-PoC

**Title:** Combining streak camera technology with ultra-fast imaging to improve mass resolution and ion throughput in time-of-flight mass spectrometry.

**Abstract:** We aim to develop a new type of detector for use primarily in time-of-flight mass spectrometry. Innovation in mass spectrometer design is largely driven by the desire for increased mass resolution and increased ion throughput. To date, improving the time resolution in time-of-flight measurements has relied on improving the detector and detection electronics in order to achieve better resolution of a time-dependent signal. Our detector approaches the problem in a different way. Utilising streak camera technology, the time-dependent signal from the ion detector is mapped onto a spatial axis, creating a 'streak image' that may be captured by a single column of pixels in an imaging sensor. By utilising multiple columns of pixels within a 2D image sensor, many such measurements may be made in parallel, providing a large increase in ion throughput relative to the 'one dimensional' signal acquisition employed in current time-of-flight detectors. To obtain time-of-flight (and therefore mass) resolutions competitive with high-end commercial mass spectrometers requires a highly specialised imaging sensor with clock speeds on the order of tens to hundreds of nanoseconds. We have recently developed such a sensor as part of the ImageMS project funded by an ERC Starting Grant. We plan to work together with Photonis, a leading streak camera

manufacturer, to develop a working prototype of the StreakMS detector which can be beta tested by mass spectrometer manufacturers. We have already carried out extensive computer simulations and design work to demonstrate the feasibility of the new detector.

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**NBR: 297424** **ACRONYM: BRIGHTEMIL** **EC FUND: 149610**

**DG:** ERCEA **Call: ERC-2011-PoC** **Thema:** ERC-OA-2011-PoC

**Title:** BrightEMIL : EMIL goes green - Exceptional Materials from Ionic Liquids for Energy Saving Applications in Photonics

**Abstract:** The idea which should be taken to the proof of concept is the application of nano energy-conversion phosphors in ionic liquids. The energy efficiency and performance of photonic devices such as CFLs (compact fluorescent lamps), LEDs (light emitting diodes) and SCs (solar cells) will be improved by more efficient use of light. For this, special nano energy-conversion phosphors (ecPs) will be coated on the respective device by a new technique relying . As no new development of the devices themselves is required, the invention has a near-market potential. The new technology will allow for a better device performance, higher energy efficiency, safer and greener production, diminish the impacts on health and environment during manufacturing as well as end-of-life. The consumption of rare materials where world-market shortage is observed will be reduced and the economic position of European companies improved.

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**NBR: 297446** **ACRONYM: UP2DM** **EC FUND: 149760**

**DG:** ERCEA **Call: ERC-2011-PoC** **Thema:** ERC-OA-2011-PoC

**Title:** Up-scaling Production of 2-Dimensional Materials

**Abstract:** Layered materials represent a diverse and largely untapped source of 2-dimensional (2D) systems with exotic electronic properties and high specific surface areas that are important for sensing, catalysis and energy storage applications. While graphene is the most well-known layered material, transition metal dichalcogenides (TMDs), transition metal oxides (TMOs) and other 2D compounds are also important. The latter materials are of particular interest as topological insulators and thermoelectric materials. Current production methods for these materials make them uneconomical for most commercial applications. The project will develop and explore commercialisation of a unique method developed by the PI for producing single atomic layer materials. It will also evaluate the potential opportunity to commercialise the materials and or devices made using these materials. The project is linked to an ERC Starting Grant awarded to Prof

Jonathan N Coleman in TCD called Semiconducting and Metallic nanosheets: Two dimensional electronic and mechanical materials (SEMANTICS). The proposal will seek to up-scale the process which has been developed within SEMANTICS (and which has already generated one patent application), and engage the commercialisation professionals in CRANN and the Technology Transfer resources in TCD to bring this technology out to the market place.

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**NBR: 297511** **ACRONYM: PELO** **EC FUND: 140375**

**DG:** ERCEA **Call: ERC-2011-PoC** **Thema:** ERC-OA-2011-PoC

**Title:** Plasmon-enhanced photoepilation

**Abstract:** Photoepilation (also known as laser hair removal) is a non-surgical cosmetic procedure that uses intense pulsed light to remove unwanted hairs and slow down their regrowth. Current approaches rely on the natural color contrast between the hair and the skin to damage the hair by photo heating. They consequently fail for fair hairs (blond and white) and, even in the ideal configuration of dark hairs on clear skin; the required light intensities are responsible for local skin injuries that can become permanent. In this project, we propose to exploit the latest advances in nanotechnology to develop a novel photo-epilation technique with reduced invasiveness, higher efficiency and wider applicability over state of the art. Our approach will first decrease local injuries of the surrounding skin by substantially reducing the required light intensity. Beyond, we expect that it could enable slowing down the hair regeneration and extending for the first time laser hair removal to blond and white hairs.

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**NBR: 297518** **ACRONYM: PROMISING** **EC FUND: 144926**

**DG:** ERCEA **Call: ERC-2011-PoC** **Thema:** ERC-OA-2011-PoC

**Title:** HIGH PERFORMANCE ATOMIC FORCE MICROSCOPE FOR IN VITRO BIO-IMAGING

**Abstract:** Atomic Force Microscope (AFM) is now a common tool for material analysis in both academic and industrial areas because it enables non-destructive high resolution images of nanometric objects. However, the available sensors face strong limitations in liquids, making the use of AFM on living material like proteins or cells still a challenge. Thanks to our breakthroughs in MEMS sensors technology, we propose to extend the AFM potential to in vitro imaging of biological objects. Targeting beyond the academic applications, our goal is to establish a marketable force imaging technique for creating and addressing new instrumentation markets from biology and life sciences to medical analysis. The proof of concept will focus on building a dedicated microscope employing

our microsystems probes for demonstrating high performance, user-friendly bio-imaging. The objectives of the present proposal are threefold: (i) verifying the innovation potential of the idea arising from the ERC Starting Grant Project "SMART" by pushing a new instrument to a pre-demonstration stage of commercialization, (ii) establishing the viability of the concept and the near term market potential, (iii) clarifying IPR position and market launch strategy. Expected outcomes lie in the consolidation of information and data making possible to take strategic decisions and to put together a reasonable and acceptable development plan.

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**NBR: 297700** **ACRONYM: PERTPROTONDYN** **EC FUND: 191675**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Aqueous Proton Mobility near Ions and in Nano-Confined Geometries

**Abstract:** Protons in liquid water posses an anomalously high mobility compared to other ions. This high mobility results from the fact that hydrated protons are not transported as intact units, i.e. by so called mass transport, but rather form defects that diffuse “structurally” through the water hydrogen-bond network. As such, aqueous proton transfer strongly relies on the structure and dynamics of the water network. Many natural and technologically relevant proton transfer reactions occur in the direct presence of ions, proteins or in geometrically confined volumes (e.g. nanopools, nanochannels). We propose to study how the nature and concentration of ionic co-solutes affects the dominant hydration patterns, conversion time-scales and local reactivity of the proton. We will also study how the structuring of the water network in nanopools and nanochannels affects the rate and mechanism of proton transfer. This will be experimentally realized by powerful spectroscopic techniques including femtosecond mid-infrared pump-probe spectroscopy and time-domain terahertz spectroscopy, which are available at the proposed host organization AMOLF (FOM) in Amsterdam, The Netherlands. Compared to conventional linear spectroscopies, these non-linear techniques are ideally suited to discriminate between the large number of sub-ensembles of local hydration patterns of the aqueous proton present in solution. The techniques will allow the measurement of the evolution of these sub-ensembles in time. The researcher, Dr. Ottosson, has a strong background in X-ray spectroscopic investigations of aqueous solutions from his Ph.D. work at Uppsala University, Sweden, making him an ideal candidate for this challenging project. With the guidance of the host scientist, Prof. H.J. Bakker – a world-leading expert in time-resolved studies of water and aqueous solutions – we believe that the chances for success are high.

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**NBR: 297728** **ACRONYM: GRAPHENE** **EC FUND: 209033**

**DG:** REA **Call: FP7-PEOPLE-2011-IIF** **Thema:** FP7-PEOPLE-2011-IIF

**Title:** Graphene Ribbon-based Nanomaterials for Electrochemical Energy Conversion and Storage

**Abstract:** Graphene ribbon-based nanomaterials were proposed to be used as electrode materials for electrochemical energy conversion and storage devices including fuel cells and supercapacitors. The objectives are to discover the fundamental electrochemical properties of graphene ribbons, to design advanced graphene ribbon-based electrode materials for electrochemical energy conversion and storage devices with significantly improved performance, as well as to demonstrate their structure-property relationship. The fundamental electrochemical properties will be investigated by various electrochemical techniques. Functionalization and chemical doping will alter the electronic properties of graphene ribbons and thus enhance their intrinsic performance for fuel cells and supercapacitors. Meanwhile, graphene ribbons could be used as supporting materials to support foreign metal and metal oxide nanomaterials as electrode materials. In the current proposal, Pt nanoparticles and nanowires will be supported on graphene ribbon as electrocatalysts for direct methanol fuel cells and various metall oxide will be deposited on graphene ribbons for supercapacitors. Finally, carbon nanotubes will be grown on graphene ribbons to obtain 3D heterjunction carbon nanomaterials for supercapacitor application. All these graphene ribbon-based nanomaterials will be demonstrated to be highly active for electrochemical energy conversion and storage devices. The proposed project is closely relevant to the Work Programme. The successful completion of the proposed project would add to the research excellence in the host orgnization, due to the sharing and application of new knowledge transferred and developed by highly qualified researchers. At the same time the projects will constitute nuclei for future research relations at international level.

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**NBR: 297876** **ACRONYM: NOMGCNP** **EC FUND: 209033**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Mesoporous Graphitic Carbon Nitrides Supported Noble Metal Nanoparticles for Green Catalysis under Visible Light

**Abstract:** The present synthetic methodologies in chemical industry must be significantly improved to enable producing many chemicals by employing environmental-friendly and sustainable procedures. One of the main challenges for establishing a sustainable society is to mimic natural photosynthesis and develop stable and efficient photocatalysts for various chemical transformations under visible light irradiation that is almost never depleted out. Chemically stable graphitic carbon nitride (g-C3N4) is an easily available organo-catalyst featuring a semiconductor band gap of 2.7 eV corresponding to an optical wavelength of 460 nm. Density functional theory (DFT)

calculations suggest that the visible-light-response of g-C3N4 photocatalyst originates from an electron transition from the valence band populated by N2p orbital to the conduction band formed by C2p orbital. In this project, novel photocatalysts based on mesoporous polymeric graphic carbon nitrides (mpg-C3N4) supported Au, Pd or Au-Pd nanoparticles (M@mpg-C3N4; M = Au, Pd, or Au-Pd) will be developed by a co-impregnation or sol-gel method. The catalytic performance of the as-prepared M@mpg-C3N4 catalyst under visible light irradiation will also be investigated. In the synthesis of hydrogen peroxide from water and oxygen catalyzed by M@mpg-C3N4, the reaction is initiated by electron (e-) and hole (h+) pairs generated by the visible-light-irradiation on mpg-C3N4. The photo-generated electron reduces molecular oxygen which directly reacts with water to produce hydrogen peroxide on the surface of noble metal nanoparticles. For the oxidation of alcohols in water, alcohols will be oxidized by hydrogen peroxide in-situ generated from water and oxygen in the presence of M@mpg-C3N4 under visible light. Moreover, oxygen activated by mpg-C3N4 under visible light will directly oxidize the primary carbon-hydrogen bonds in toluene by noble metal nanoparticles in M@mpg-C3N4 to efficiently produce benzyl alcohol, benzaldehyde, etc.

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**NBR: 297921** **ACRONYM: TOMOMECH** **EC FUND: 228082**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Nanomechanics of natural materials from combining tomography and finite element modelling

**Abstract:** Porous sedimentary rocks compose a large part of the European coastline and are major oil reservoirs in Europe, yet little is not known about their nanoscale structure and mechanical properties even though these parameters are linked to macroscale behaviour. The aim of TOMOMECH is to combine X-ray tomography and finite elements modelling (FE) on the nanoscale to make predictions about the stability of e.g. chalk cliffs and the remaining oil in depleting reservoirs. My model for determining stability will be versatile, which I will demonstrate by applying it to biomineralised shells as well, to elucidate nature's design strategies. The combination of tomography and FE has been employed successfully before to examine the structure and functionality in trabecular human bone on the microscale. A main objective of TOMOMECH is to transfer this approach to the nanoscale and adapt it for determining pore structure in sedimentary rocks. The results will be applicable to coastal protection, oil production and biomimetic materials. Through a direct connection to industrial partners, a focus on applicability is ensured. My background in Physics, combining X-ray techniques and modelling from the molecular to the continuum scale will underpin this project but I will also benefit from the training in new nanoscale characterisation techniques that I will receive. Interdisciplinary research has been a major topic in my career and TOMOMECH will give me the opportunity to further broaden my scientific background. The approach I will

develop and the chance to run my own project will give a good push in my future career. Mentoring by my host, Prof. Stipp, who is an expert in nanoscale characterisation, and interaction with the Nano-Science Center, Copenhagen, will ensure progress, help increase my network and provide tremendous benefit.

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**NBR: 297929** **ACRONYM: SMARTSTRUCTURES** **EC FUND: 209033**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Synthesis of Smart Virus-like Hierarchical Structures Based-on Polymer-Peptide Conjugates and the Potential Application in Drug Delivery

**Abstract:** In this proposal, we intend to combine the advantages of virus and polymersome structural motifs into one integrated model as a promising strategy to construct hybrid structures that are efficient delivery vehicles. First, folic acid-modified polyN-(2-hydroxypropyl)methacrylamide-poly(L-cysteine) conjugate (FA-PHPMA-b-PLC) will be synthesized. The biocompatible PHPMA is used as the hydrophilic part, and PLC is chosen for its ability to aggregate in water (by either hydrogen or covalent bonding via beta-sheet formation or disulphide linkage). Not only do the thiol groups in PLC chain play an important role for covalent loading of drugs/proteins/genes via thiol exchange with disulfide groups, but also the oxidation of the cysteine residues to form intra- and intermolecular disulfide bridges further stabilize the polymersome structure. After forming the polymersome, the biomolecules will be incorporated by either covalent or noncovalent mechanisms. Finally, zinc oxide nanoparticles modified by disulfide-linked pyridine will be covalently encapsulated into the PLC shell to obtain the hybrid virus-like structure with ZnO nanoparticles as a key component of the coronal layer. We anticipate that the constructed hybrid structure will enter the target cell by endocytosis. The low pH in the endosome (pH~5) will then accelerate the dissolution of the ZnO nanoparticles and release the biomolecules. Subsequently, glutathione in the cytoplasm will reduce the cross-linked disulfides in PLC shell and lead to the disassembly of the polymersome. Therefore, as a new hybrid structure that integrates significant advantages of both the polymersome and virus models of biomolecule delivery, it is reasonable to believe that it will provide a new advance for the design of delivery vehicles for the cure of cancer-related diseases.

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**NBR: 298012** **ACRONYM: NFESEC** **EC FUND: 209033**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Nanophotonics for Efficient Solar-to-H2 Energy Conversion

**Abstract:** Photoelectrochemical H2 production from water is a field of high present interest. This project is to design nanophotonics for efficient solar-to-H2 energy conversion. A method will be developed for fabricating nanophotonic structure (such as inverse opal photonic crystals, nanoarray photonic structure) of narrow band gap ternary metal oxide as photoanodes, for example, BiVO4 (2.4 eV), InVO4 (2.0 eV), BiFeO3 (2.2 eV), etc. Highly efficient solar-to-H2 energy conversion is expected to be achieved due to the superiorities of the structure and unique optical properties of nanophotonic structures, including stronger interaction between light and the photoelectrode induced by the stop-band edge effect, greatly improved light harvesting due to the multiple scattering effect, efficient photogenerated charge carriers separation due to the distance for photogenerated holes to reach the interface of semiconductor and the electrolyte can be significantly reduced. The proposed project will try to address how nanophotonic structures with their unique physical properties can enable efficient harvesting of light.

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**NBR: 298022** **ACRONYM: NIRPLANA** **EC FUND: 193726**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Near-Infrared Semiconductor Plasmonic Nanocrystals for Enhanced Photovoltaics

**Abstract:** Plasmonics is a hot and rapidly expanding research field. Of particular interest is the localized surface plasmon resonance (LSPR) observed in noble metal nanocrystals (NCs). It leads to strong light scattering and enhanced light-matter interaction. However, the LSPR of metal NCs is restricted to visible wavelengths, unless multipole resonances are enhanced via shape engineering of the NCs. Recently, two papers were published showing that copper-deficient semiconductor Cu2-xS(e) NCs can also exhibit a strong LSPR, in the near-infrared (NIR) spectral region. This exciting result both pushes the LSPR to longer wavelengths and allows plasmonics using semiconductor materials, which are transparent near the LSPR wavelength. The project aims at expanding this new field by focusing on the fabrication of a NIR photovoltaic cell with enhanced performance. This is achieved through incorporation of NIR plasmonics NCs, which allow improved absorption in the active layer via strong light scattering in NC thin film and an enhancement of the electric field near the NC surface. Two crucial steps need to be taken to achieve our goals. First, we need to further develop the synthesis of novel NIR plasmonic NCs. The focus lies here on a tuning of the spectral position and width of the LSPR by varying the Cu2-xS(e) material composition, size and shape, in order to optimize the NC scattering cross section and field enhancement at the desired NIR wavelength. Second, strategies will be developed to incorporate the plasmonic NCs into novel NC-based thin film photovoltaic cells. The device performance will be evaluated with and without plasmonic NCs, for different thin film configurations, in order to quantify the efficiency enhancement. Considering that our devices combine an improved absorption with an expansion of the photovoltaic response into the NIR, we expect that NC-based photovoltaics can offer a viable low-cost alternative to current solar cell technologies.

**NBR: 298060** **ACRONYM: OP2M** **EC FUND: 164684**

**DG:** REA **Call: FP7-PEOPLE-2011-IOF** **Thema:** FP7-PEOPLE-2011-IOF

**Title:** Optical Probe and Manipulation of Magnetization at the nanometer scale

**Abstract:** This project focuses on fundamental scientific issues of spin manipulation in nano-structured magnetic materials subject to optical/magnetic excitations and further provides the scientific underpinnings of next generation of heat-assisted magnetic recording (HAMR). The research will focus on two related research themes (i) ultrafast magnetization dynamics, (ii) optical switching of nanomagnets which have the common property of using optical pulses to both probe and manipulate magnetism at the nanometer spatial and femto-second temporal scales. The strength of this project is to address a novel and challenging scientific program by bringing together international experts with complementary expertise: Ultra-fast optical (Y.Fainman UCSD) Nanomagnetism and spintronic (S.Mangin SM the applicant) Nanomagnetic theory and modeling (V.Lomakin UCSD) Magnetic data storage (E.E. Fullerton EEF the outgoing host) The partner organisation CMRR at the University of California, San Diego (UCSD) is directed by EEF. This famous research centre serves as a catalyst for joint investigations between industrial and academic partners. EEF is an outstanding scientist (235 papers, 80 invited talks, 48 US patents, h factor = 42). The collaboration between EEF and SM has already been very active and productive in the past. This program will be a unique opportunity to take the collaboration to a higher level on an innovative and original scientific project and on a broader scale (with new members and student of both partner and host organisation). Since both collaborators are taking more responsibilities a strong trans-Atlantic collaboration will be profitable for their carriers and their institutions. It is also an exceptional chance to bring back to the host organisation competence and knowledge on this new field, maintain a level of excellence for the applicant and his team and create links with industrial partners. Phase 1: CMRR - USA for 13 months / Phase 2 IJL - France for 12 months

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**NBR: 298107** **ACRONYM: NANOFACT** **EC FUND: 371166**

**DG:** REA **Call: FP7-PEOPLE-2011-IOF** **Thema:** FP7-PEOPLE-2011-IOF

**Title:** DEVELOPMENT OF BIOACTIVE NANOCOMPOSITES FOR BONE TISSUE ENGINEERING APPLICATIONS

**Abstract:** Bone has a remarkable capacity to heal. However, in some instances the amount of bone which is needed to heal exceeds its healing capacity. These cases arise following

accidents, infection or surgery to remove cancerous tissue and they result in the need to perform approximately 600,000 surgical bone grafting procedures annually. These procedures have inherent disadvantages and so there is an urgent clinical need to develop a tissue engineering alternative to bone grafting. In this study an osteoconductive/osteoinductive nanoscaffold will be designed to retain growth factors with proven osteogenic potential within their structure. As such, relatively low doses of these expensive molecules can be retained at the bone defect site. The technology developed in this study has enormous potential to reduce the overall burden placed on patients and on European healthcare systems by reducing the costs involved in using Growth Factors in a variety of applications. To perform this work the Fellow will move from Athlone Institute of Technology, Ireland to join a leading orthopaedic research group at one of Harvard University's teaching hospitals where he will be trained in nanotoxicity testing, detection of growth factor release, cell loading and orthopaedic preclinical models. The Fellow has extensive knowledge in the field of biomaterials and orthopaedic research having trained at the AO Research Institute, Davos, Switzerland. However this fellowship will allow him to develop his knowledge in the field of biocompatibility testing. Knowledge developed in this area will be transferred back to Europe during the return phase of the fellowship. This knowledge will allow the Fellow to further refine the research carried out at Harvard. The goal of this research is to develop translational solutions to clinical problems. Indeed, the chance to work at Harvard would be hugely beneficial in developing direct links to clinicians at one of the world's most prestigious Universities.

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**NBR: 298246** **ACRONYM: GREAT** **EC FUND: 193594**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** GRaphene supramolEculAr elecTronics: a life-long training Career development project

**Abstract:** GREAT aims at offering to a young scientist with an excellent scientific record, possessing a Ph.D in chemistry, a cross-disciplinary and supra-sectorial training and research experience in the emerging field at the interface between physics, materials sciences, supramolecular chemistry, electrical engineering and nanoscience with the ultimate goal of offering him an education in a new field of research and broadening his skills in science and complementary subjects. The overall mission is to train the young researcher to become an independent scientist as well as to prepare him for a leading position in academia or industry. Within GREAT the training-through-research is targeted at exploiting tailor-made graphene organic based systems to study their structure and electronic properties and ultimately to assess their potential in photovoltaic applications and more generally in (opto)electronic devices. Understanding and bottom-up tuning of graphene properties is essential for its potential optoelectronic applications since organic-derivatized graphenes show improved conductivity, charge mobility and mechanical strength. To accomplish this goal, we will combine bottom-up

and top-down approaches: graphene-hybrid materials prepared by either covalent modification or by supramolecular functionalization of graphene with functional molecules in a given liquid media will be self-assembled forming multicomponent architectures with a high degree of order at multiple length scales, i.e. from the nano to the macroscopic scale. These architectures will be employed as semiconducting layers in field effect transistors (FETs) and solar cells (SC's), or as transparent electrodes as alternative to ITO electrodes. Prototype of devices will be fabricated in order to investigate in depth and in a broader context two fundamental physical properties for optoelectronics, i.e. charge injection and charge transport characteristics.

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**NBR: 298337** **ACRONYM: AMORPH** **EC FUND: 192622**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Analysis and Modelling of the Reactivity of Pozzolans during Cement Hydration

**Abstract:** Currently, the annual global cement production is estimated to be 3.3 billion tons1. Even though the CO2 emissions associated with the final product, concrete, are low, the massive scale of production, means that the cement industry accounts for 5-8 % of the global annual anthropogenic CO2 emissions3. One of the most effective ways to improve sustainability is the blending of Portland cement with supplementary cementitious materials (SCMs)2,3. However many local sources are fully exploited and a decline in production of blastfurnace slags and fly ash is expected due to future developments in steel and electricity production4. Therefore locally available alternatives to these traditional SCMs need to be found to achieve higher cement replacement levels and a more sustainable cement industry. Unravelling the impact of this expanding and diversified group of SCMs on the hydration reactions and performance of cement constitutes a major scientific challenge. The diversity of SCMs calls for novel generic approaches that will enable direct prediction and control of performance; compared to the current practice of case-by-case empirical testing. This project proposes a novel interdisciplinary approach, building on the geological background of the fellow combined with the materials science perspective of the host. Novel concepts of surface chemistry, recently developed in geochemistry, will be applied to the behaviour of SCMs in cement. The focus will be on investigating the effect of SCM and solution chemistry on the rate of the nanoscale surface processes of dissolution and precipitation. The impact of SCMs on the product assemblage and microstructure will be modelled and compared to experiment, exploiting recent breakthroughs in thermodynamic and microstructure modelling of cement systems. Finally, the results obtained will be transferred to practice through practical methodologies for testing SCM reactivity in a basic laboratory environment.

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**NBR: 298405** **ACRONYM: XFEL SAMPLE INJECTOR** **EC FUND: 140289**

**DG:** REA **Call: FP7-PEOPLE-2011-IIF** **Thema:** FP7-PEOPLE-2011-IIF

**Title:** Hydrated Injection of Biomolecules into X-ray Free Electron Lasers (XFEL)

**Abstract:** Building upon the Gas Dynamic Virtual (GDVN) technology developed by the researcher at his home institution and upon the very successful use of these injectors for biomolecular structure measurement with seminal X-ray Free Electron Lasers (XFEL's), this project will enhance and expand GDVN capabilities for both the current and the next generation of XFEL's. Specific goals of this project are (1) reduction of sample consumption from the 1-10 microliters/minute of the current GDVN injectors down to under 100 nanoliters/min, (2) development and testing of specific experimental methods (capillary coatings, new GDVN methodology, improved flow systems) to expand the variety of biological samples that can be delivered using GVDN injectors, and (3) porting of this technology and knowledge to the European XFEL communities.

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**NBR: 298531** **ACRONYM: TAPIR** **EC FUND: 201932**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Transport Properties of Ion-Beam Shaped Metallic Nanowires in Vertical Geometry

**Abstract:** The study of the transport properties of nanowires grown by bottom-up approaches is a fundamental step toward their technological integration into a real device. Their integration into complex electronic devices by simple and controllable methodologies is the key issue to achieving the evolutionary progress that should permit to improve computers and communication systems such that they offer superior performances and enhanced miniaturization associated with increased computational speed, tera-bit storage capacity, ultra-low energy consumption, and reduced costs per function. The final goal of the TaPIR project is to explore new areas of this research field creating new scientific possibilities beyond the boundaries of conventional technologies and applications. The TaPIR project focuses on a threefold objective: i) developing a novel nano-engineering technique -the so called ion-beam shaping technique- to transform embedded metallic spherical nanoparticles into prolate nanorods and nanowires, with an aspect ratio that can be tuned by the ion type, energy and ion beam fluence, ii) to contact them in a vertical geometry and iii) to study their transport properties both from the spin-dependent and from the mesoscopic point of view. The originality of the work proposed resides in elaborating a unique combination of ion-irradiation, colloidal chemistry and nanostructuration techniques to obtain and to study contacted ion-shaped NPs in a vertical configuration. In this respect, our approach is certainly unique and must be considered as an innovating and hitherto unexplored pathway to produce

configurations of contacted NPs that are not accessible by merely standard techniques. Furthermore, the project represents an exceptional opportunity to yield new insights within the field of the transport properties of materials at the nanoscale.

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**NBR: 298546** **ACRONYM: PBCOATINGS** **EC FUND: 169800**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** New strategies for corrosion inhibition coatings for lead and its characterization by in-situ spectroelectrochemical studies

**Abstract:** Lead is susceptible to corrosion in the presence of organic acids and humidity. This accelerated degradation seriously affects cultural heritage objects, it takes place in display cases in museums and is has become a serious issue on organ pipes in churches or concert halls. The pipes of ancient organs are made from lead and the organic acids are emitted from the wooden parts in the organ (the windtrunks and the windchests). The aim of this proposal is the development of environmentally safe corrosion protective coatings for lead heritage objects which are stable, reversible, easy to apply and to remove, and aesthetically justified. Monocarboxylate coatings have shown very promising results, but the effectiveness is highly dependent on carbon chain length, and carboxylate concentration in the solution: higher chain length and concentration, the better the corrosion inhibition effect. Unfortunately, the solubility of monocarboxylates drastically decreases with chain length. The project aims to tackle the key issue of the low solubility of monocarboxylates. As opposed to the strategy of using cyclic voltammetry for coating formation (only applicable to small objects), our idea is to test new coatings easily applicable on site to heritage objects of all sizes, for instance organ pipes. Ideas to be tested include solubilization of monocarboxylates in ethanol and propanol solutions; dispersion of monocarboxylic acids in microemulsions together with surfactant and co-surfactant; embedding this microemulsions in polymeric networks (gels); test of hydroxide nanoparticles as alternative coatings; and the combination of hydroxide nanoparticles and microemulsions as combined optimum coatings. The coating formation and its corrosion resistance will be fully characterized by several surface analyses techniques in the host lab, including electrochemistry, complemented by synchrotron spectroelectrochemical studies.

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**NBR: 298596** **ACRONYM: PEQUPHOT** **EC FUND: 176053**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Plasmonically-enhanced Quantum Dot Photodetectors

**Abstract:** Plasmonics has received a lot of attention because of the unique optical properties of metal nanostructures that allow, for example, strong focusing of light and strong field enhancements. While plasmonics is widely proposed for improving performances of optoelectronic devices, its applicability still has to be proven. Photodetectors are well-established for different applications ranging from digital photography to biomedical imaging. However, because of their versatile use there is a great demand for low-cost devices. One way to achieve low-cost photodetectors is by employing solution-processed quantum dots as active material. Quantum dots are a promising medium because of the tunability of the absorption spectrum by varying their size due to the quantum confinement effect and because of the low-cost fabrication technique due to their solution processability. However, the performance of quantum dot photodetectors has been limited so far to either being ultra-sensitive, but rather slow, or high-speed with a low sensitivity. We will break this compromise by concentrating light into nanoscale semiconducting volumes by employing plasmonic structures. Therefore, we will numerically simulate the interaction between the incident light, the plasmonic structure, and the absorbing quantum dots, by using commercial simulation software. In a next step, we will fabricate the plasmonic structures and we will determine an optical absorption enhancement by measuring the photoluminescence of the quantum dots in the vicinity of the plasmonic structure. In a final step, we will fabricate the actual photodetector and characterize its performance by optoelectronical measurements.

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**NBR: 298740** **ACRONYM: CO2PHOTORED** **EC FUND: 176053**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Carbon dioxide photoreduction: A great challenge for photocatalysis

**Abstract:** The reduction of carbon dioxide has received a great deal of attention in recent years. With increasing concerns about rising atmospheric CO2 levels, scientists have discussed new strategies to reduce the impact of CO2 on global warming. Many ideas have involved trapping the “greenhouse gas” and converting it into fuels and organic materials, using either light or electrical energy. In this context, one of the main challenges of photocatalysis is to enhance the photoreduction of carbon dioxide. This is an ambitious aim, but it could be achieved now because of the convergence of new experimental and theoretical developments. More specifically, the aim of the project is the activation of carbon dioxide followed by its photoreduction toward useful organic compounds using electron-transfer processes on heterogeneous catalysts. In this context, the new topics that will be studied are: 1) the semiconductor deposition/encapsulation on/in a nanoporous support/host which will acts as a cooperative entity in the photoreduction of CO2 by performing a proper adsorption of the substrate molecules; 2) study and development of the new doping strategies for improving the photoactivity and the ability to absorb visible solar spectrum; 3) the development of a new CO2 mitigation strategy by studying and preparing photoreducers

and hybrid photosensitizer – semiconductor systems, and 4) use of the developed materials in a photoreactor. The last topic represents the first step into a new technology for artificial photosynthesis. Reaching the objectives of the proposal will open a wide field of investigation that goes far beyond questions of developmental of photocatalysis. The originality and innovative nature of the project lie in the link between chemical, physical and photo-physical properties of the developed materials.

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**NBR: 298811** **ACRONYM: EPOQUES** **EC FUND: 185763**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Exciton-Polariton Optoelectronic and Quantum Employment in Semiconductors

**Abstract:** Both electrons and photons have emerged as essential particles in our information age. Electrons interact strongly with each other and form the basis for computational architectures, while photons interact weakly and are the ideal candidates for communication. While the strength of each particle can also be viewed as a weakness, an emerging research field has focused on the fundamental physics of hybrid particles between electrons and photons. Known as exciton-polaritons, such particles can be generated in solid-state nanostructures such as semiconductor microcavites. Naturally, exciton-polaritons exhibit a mix of properties of electrons and photons and recent fundamental studies have revealed their Bose-Einstein condensation, superfluidity and a rich spin dynamics. With a range of basic physical effects now known, the potential for constructing devices from these hybrid particles has appeared, yet remains largely unstudied. Optical or electrical spin control of exciton-polaritons has a perspective for information processing, where the strong non-linear interactions between excitons could be sufficient for a complete logical functionality. Going beyond classical effects, exciton-polaritons are quantum particles and seem to be realistic candidates for quantum information processing. Unfortunately the field of exciton-polariton physics has evolved rather separately from the field of quantum information science, likely due to the difficulty in applying the most basic ideas of quantum information theory to exciton-polaritons. Namely, it is not known how to isolate exciton-polaritons as qubits (since they are bosons) such that more advanced schemes based on continuous variables are required. The aim of this project is to design and study theoretically exciton-polariton based devices. To understand the promise and limitations of these particles an interdisciplinary project between condensed matter physics, quantum optics and quantum information theory is essential.

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**NBR: 298821** **ACRONYM: UHMSNMRI** **EC FUND: 193726**

**DG:** REA **Call: FP7-PEOPLE-2011-IIF** **Thema:** FP7-PEOPLE-2011-IIF

**Title:** Design and testing of Gd3+-Loaded Ultrasmall Hollow Mesoporous Silica Nanosphere Platform as High Sensitivity Probes for Targeted Magnetic Resonance Imaging of Tumor In Vivo

**Abstract:** The widespread use of magnetic resonance imaging (MRI) technology in clinical and scientific research has attracted great interest in designing high relaxivity contrast agents to improve their sensitivity for the early stage detection of cancer. A number of nanostructure-based T1 contrast agents have been reported in recent years but they are still suffering some limitations for an efficient translation to in vivo applications. In this proposal, we'll develop a novel Gd3+-loaded ultrasmall hollow mesoporous silica nanosphere (Gd-UHMSNs) platform as high sensitivity MRI probes for targeting T1-MRI of small animal tumor xenografts and potentially, of cancer patient. The specific aims for the proposal are (1) synthesize UHMSNs, and design routes to couple the particles with Gd-complexes, PEG, RGD or other targeting vectors ; (2) evaluate the relaxivity, toxicity, specific targeting capabilities of Gd-UHMSNs-RGD through tests in cell culture; and (3) evaluate the targeting agents for MRI detection of tumors in different types of mice models. Compared to the current contrast agents, the Gd-UHMSNs-RGD hopefully will show many advantages such as (1) the nanoporous and hollow structural will offer effective geometrical confinement of the Gd-complex and water molecular for enhances the r1 relaxivity, (2) the small particle size< 50 nm, high dispersivity and low toxicity is expected to avoid the RES uptake and efficiently prolong the half-time of circulation in body, (3) the RGD vectors will allow the accumulation of the particles at the tumor endothelium and at the tumor cells. Success of this project can not only provide theoretical insight to the development of nanoparticle-based high relaxivity and targeting contrast agents, but also guide us to develop a novel contrast agent for pre-scanning patients and personalized nanomedicine, resulting in great commercialization potentials.

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**NBR: 298841** **ACRONYM: BIOBRIDS** **EC FUND: 209033**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Hierarchical Electroactive Hybrids exploiting Biological Motifs (BIOBRIDs)

**Abstract:** We here propose a new approach to the formation of Hierarchical Electroactive Hybrids exploiting Biological Motifs, which will provide new strategies and tools for control that will define future bottom-up 3D construction of materials in the field of functional nanomaterials for nanoelectronics. Functional electroactive oligo(aniline)s, combined with guanine hydrogen-bonding units, will be combined with single-stranded DNA block copolymers in rationally designed ways, so that information encoded in the biological materials will control spatial placement and orientation, interactions and level of

functionality in three dimensions within the formed complex and hierarchical superstructures. This groundbreaking approach will utilise combinations of DNA block copolymer (BCP) self-assembly, electroactivity and encoded self-assembly, and will open unexplored avenues in the priority areas of nanotechnology, nanoelectronics and advanced materials through its interdisciplinary and multidisciplinary approach. This proposed research will rely on modern synthetic protocols of organic chemistry, chemicophysical analyses of optoelectronic properties and structure-property interplay, self-assembly in the solid state, device fabrication and testing. It is expected that the outcomes of this proposed research will impact across these disciplines, and contribute knowledge to a high priority area for both society and the research community within the EU and beyond. This fellowship and project will be an important step forward in the research career of Dr. Dasgupta, who has experience and a very strong track record in the synthesis and assembly of functional molecular architectures and supramolecular aggregation. Dr. Dasgupta will therefore be enabled, through this Marie Curie fellowship, to systematically investigate this highly relevant research area that has been left unexplored to date, and thus develop his independent scientific career fully.

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**NBR: 298861** **ACRONYM: NEMO** **EC FUND: 178760**

**DG:** REA **Call: FP7-PEOPLE-2011-IOF** **Thema:** FP7-PEOPLE-2011-IOF

**Title:** Nanowire electro-mechanical-optical systems

**Abstract:** The aim of this project is the realization of a new class of electrical devices, in which mechanical deformation of a nano-object are used to tune its electronic transport properties. This is done through the use of radiation-pressure actuated optical forces on suspended one-dimensional electronic systems, such as semiconductor nanowires. While research in opto-mechanical systems and electro-mechanical systems is advancing at a rapid pace, the joining of the two fields is still lacking and opto-electro-mechanical devices are scarcely investigated. In these devices spatial deformations control the electronic properties of nano-object; suspended nanowires, for example, can oscillate (guitar string modes) modifying their distance with a back-gate electrode, linking mechanical deformation to an effective gating field which, in properly designed system, can control the flow of single electrons (Coulomb blockade). This proposal considers the realization of on-chip systems in which this dynamic is controlled by the use of optical forces, to obtain a precise and reliable tool to address the nanometric displacement of the object. Exploiting the capability of nanowires to sustain fiber-like optical modes, a coupling of photonic modes between an optical waveguide/microcavity is envisioned. Apart from its interest as a mini-invasive waveguide detector, this will open the route to the investigation of mechanical modes of nanowires coupled with optical waveguides/cavities or in LC resonant circuits, with the achievement of controlling the vibrational state of the object by shining light into the optical system. The final goal is the realization of optically controlled electro-mechanical transistors, both field-effect

and single electrons, which could represent an absolutely new kind of device for sensing and a new exciting platform for fundamental physics invetigations.

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**NBR: 298918** **ACRONYM: JANUS DYNAMICS** **EC FUND: 145196**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Magnetization dynamics in anisotropic magnetic nanoparticles investigated using time-resolved X-ray and neutron scattering techniques

**Abstract:** The magnetization relaxation of nanosized magnetic objects plays an important role for their technological applicability. For applications in data storage, a large magnetic anisotropy is required in order to retain the magnetization state in the required relaxation time and temperature range. For application in the fields of magnetic imaging or magnetic hyperthermia, however, the electromagnetically induced relaxation of superparamagnetic nanoparticles is desired. Magnetization relaxation effects depend on the interplay of magnetic anisotropy and volume and are thus largely influenced by the nanoparticle composition, shape, interface effects, and interparticle interactions. In this project, we will quantitatively investigate the magnetization relaxation of magnetic nanoparticles and their assemblies. In particular, the effects of shape anisotropy, exchange bias, and magnetoelectric coupling in anisotropic nanoparticles will be explored. Janus nanoparticles, consisting of two epitaxially aligned hemispheres of different composition, allow for a controlled variation of anisotropic shape and interface effects in nanoparticles, and thus represent suitable model systems for the proposed study. Particular emphasis will be given to multifunctional Janus particles, combining e.g. magnetism and polarity with low dimensionality, which may potentially serve as building blocks for multifunctional nanomaterials. We will investigate the magnetization relaxation effects by application of advanced X-ray and neutron scattering techniques including stroboscopic small-angle scattering and nuclear resonant X-ray scattering. As a result, we expect to gain precise information on the influence of exchange bias, magnetoelectric coupling, and interparticle interactions on the Néel relaxation. This will improve the understanding of magnetization dynamics in anisotropic nanoparticles and may thus contribute to the exploration of further suitable nanomaterials for technological applications.

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**NBR: 298932** **ACRONYM: NOVOSIP** **EC FUND: 318514**

**DG:** REA **Call: FP7-PEOPLE-2011-IIF** **Thema:** FP7-PEOPLE-2011-IIF

**Title:** Nano-Voids in Strained Silicon for Plasmonics

**Abstract:** The project aims at exploring the use of nanovoids and nanodots prepared as plasmonic structures to enhance the efficiency of Si single-crystalline photovoltaic (PV) devices. Fabrication and experimental investigation of plasmonic structures in strained Si/SiGe multilayered structures will be carried to enhance light harvesting in solar cells due to both near-field and far-field effects. The main idea behind the production of nanovoids and nanodots is based on the ability of compressively strained thin SiGe alloy layers, incorporated in a Si matrix during epitaxial growth, to collect small-sized molecules (H, He, C) or vacancies, induced by irradiation. Further, thermal treatment results in the formation of nano-voids which are strictly assembled within the strained SiGe layers. The following key processes will be used: Molecular beam epitaxy of strained Si/SiGe/Si structures followed by irradiation with light ions (hydrogen, carbon) and rapid thermal treatment. This structure will then be additionally used as a template for segregation and self-assembling of metallic or carbon nanodots. The fundamental investigations of the structural, optical and electronic properties of the strained Si/SiGe layers will be carried out with a range of available methods for structural, electronical and optical characterization. By placing the nanovoids and nanodots in a highly doped emitter layer close enough to the p-n-junction that the near-fields will extend into the depletion layer, the effects of near-fields will be obtained. This will give a contribution to the electron-hole pair generation, and this will be additional to the far field effects. Being formed periodically, strained layers with self-assembled nanovoids or nanodots will display fundamentally unusual electronic and optical properties. These effects have not previously been experimentally studied in a solar cell configuration. The present system offers a unique configuration for such investigation.

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**NBR: 299094** **ACRONYM: CONAT** **EC FUND: 250106**

**DG:** REA **Call: FP7-PEOPLE-2011-IIF** **Thema:** FP7-PEOPLE-2011-IIF

**Title:** Conduction Mechanisms in Advanced MOS Technologies

**Abstract:** Silicon-based technologies are approaching their physical limits, and technology breakthroughs, in terms of materials and processes, will be required as device sizes reach the nano-scale frontier. To face these challenges, a new generation of devices based on a clever combination of selected materials is currently under consideration worldwide. The aim of this project is to investigate the conduction mechanisms, in connection with degradation and breakdown characteristics, of Metal Gate/High-K structures on III-V substrates intended for applications in future MOS transistors. This aspect is primary obstacle to the successful incorporation into mainstream semiconductor process. To the date, no systematic study about these topics in such advanced structures has been carried out. The project covers all aspect of conduction in the MG/HK/III-V stacks, fresh, stressed and, finally the breakdown event and the conduction over the degraded stacks. The electrical characterization will provide relevant information to contribute to the elaboration of models that are able to predict

the life time of devices more accurately. Leading the transition to advance electronics is a challenge for applied research as it requires specific technologies platforms. That is actually why this proposal is highly interesting. This research project would contribute to achieve excellence in the filed and consequently would attract the interest of the industrial sector of the EU. This proposal aims to define advantages and constrains of advance MG/HK/III-V stacks since they will play a relevant role in the next generation of CMOS manufacture process

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**NBR: 299141** **ACRONYM: REQS** **EC FUND: 167390**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Reliable quantum simulators

**Abstract:** Building analogue quantum devices that can simulate the behaviour of other quantum systems more efficiently than any classical apparatus is deemed possible and highly desirable. Such advances will give immense boosts to a variety of fields, from nano-devices to quantum chemistry and information technology. A major current roadblock to this end is the fact that special-purpose quantum simulators have no known mechanisms of self-stabilisation or validation protocols; while it is perfectly known that errors are unavoidable in any experimental setting and even that many of the target systems of interest possess regimes of extreme sensitivity against perturbations. Furthermore, our current understanding of the effects of imperfections on real-world quantum simulators is remarkably poor. The latter is precisely the main reason why it is still not known whether quantum simulators will actually be more powerful than conventional computers at simulating quantum-mechanical systems. Reliable Quantum Simulators (REQS) will contribute to answer this question. In a first stage we plan to derive scaling laws with the system size for the behaviour of generic quantum simulators under realistic noisy conditions. We will then develop interactive protocols to validate the outcomes of realistic noisy simulations. In a final stage, we plan to gain insight on the true usefulness of real-world quantum simulators. This will include obtaining formal evidence on whether or not the latter are hard to simulate for classical computers. Ultimately, the breakthrough character of REQS lies at directly challenging a current common view that sustains that quantum simulators are intrinsically so robust that they do not require validation or error correction. That is, REQS will address the uncomfortable question that quantum simulators could be unreliable, or, equally bad, reliable only in the trivial regimes.

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**NBR: 299264** **ACRONYM: BOOSTQUANTUMCHEM** **EC FUND: 174475**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Boosting the performance of Quantum Chemistry for nanocatalysts, biomolecules and graphene layers by solving the fundamental drawback of van der Waals interactions in Density Functional Theory

**Abstract:** The goal of the proposed IEF project is to develop a novel Density Functional Theory (DFT) method, which will facilitate the very efficient investigation of large macromolecules. DFT is the most used quantum chemical method today, as it allows, at a low computational cost, to perform research at a quantum chemical level on systems containing up to thousands of atoms. However, standard DFT only includes a poor description of dispersion interactions, which occur in systems such as peptides, DNA base-pairs, graphene layers and heterogeneous catalysts. To overcome this great disadvantage the IEF will: a) transform a model for evaluation of dispersion energies at DFT level into a pragmatic and accurate methodology. b) implement the methodology, through design and application of advanced computational chemistry techniques into an efficient and user-friendly software. c) apply this novel DFT method on high-profile problems (nanocatalysts, biomolecules, graphene layers) The results will directly impact research in biochemistry, material science, catalysis and supramolecular chemistry boosting fast and accurate studies on numerous macromolecular systems. The applicant is an expert in DFT, who will complement her skills in Computational Chemistry and design of methods within the Theoretical Chemistry Group at the University of Kaiserslautern (Germany), who are leading scientists in the field. These investigations will allow the fellow to acquire excellent expertise in a pioneering research topic, which is of crucial importance for the worldwide efforts for using macromolecules in innovative technologies. In combination with the complementary training, this IEF project will help the applicant to obtain scientific maturity and actively participate in shaping future research regarding DFT methodologies for large systems, which is a rapidly emerging field. Consequently, the IEF perfectly consolidates the fellow's long-term aim to reach an independent research position in Europe

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**NBR: 299266** **ACRONYM: NANOGEND** **EC FUND: 209033**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Novel Thermoresponsive Organic Nanogels for Topical Gene Delivery of RNA-Based Drugs

**Abstract:** The scientific aim of this project is to develop and characterize a selected set of novel intelligent nanogels, designed to be able to cross the Stratum Corneum of the skin, and to study their suitability as drug delivery systems in inflammatory skin diseases. Ultrasmall nanogels will be synthesized using high dilution radical polymerization, a technique well established in the host's laboratory, which allows the control of the

particle size and polydispersity. Three different groups of nanogels will be prepared: 1) fluorescent nanogels 2) molecular imprinting nanogels 3) thermoresponsive nanogels. The first group will be used to study the distribution and localization of nanogels in normal human skin model reproduced in vitro by organotype cell co-culture. The second group will be used to evaluate the molecular imprinting approach as a tool to obtain very selective delivery system with high recognition characteristics. This has not been studied before and will provide a unique approach, when coupled with high permeation characteristics. The last group, the thermoresponsive nanogels, will combine good permeation with ability to release the drug following a change in temperature and will be compared with more traditional systems. The project will explore the use of each nanogels set to complex and deliver (a) small anti-inflammatory drugs, and (b) large molecules, in particular siRNA, given the strong expertise of the applicant in this area and the emerging interest for these new therapeutics in topical administration. Penetration and pharmacological effects of the drug-nanogels complexes will be assessed in pathological skin in vitro model by the improvement of the disease phenotype. The most significant novelty of the project will be the development of new organic polymeric nanogels able to cross the SC of the skin, providing a new non-invasive gene delivery technology system, that could bring very important applications in dermathology as well as in other fields.

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**NBR: 299283** **ACRONYM: BRAIN STED** **EC FUND: 167390**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Intravital optical super-resolution imaging in the brain

**Abstract:** Synapses are small, highly specialized structures of intercellular contact that play a crucial role in neuronal information processing and memory. While traditional fluorescence microscopy is an extremely powerful tool to study the dynamics of biological processes in vivo with molecular specificity, it has insufficient resolving power to dissect details of synaptic structure and functional organization or the structure of small subcellular components. In contrast, far-field optical super-resolution techniques provide spatial resolution at the nanoscale beyond the limit imposed by the diffraction of light. However, current super-resolution techniques are limited to thin brain preparations or to the surface of thick samples. The central aim of this proposal is to establish optical super-resolution methods for imaging chemical synapses in all layers of the cerebral cortex and in deep lying structures of the brain and to apply these techniques to timely questions in neurobiology. We will develop intravital super-resolution microendoscopy based on the stimulated emission depletion (STED) technique. This will enable intravital microscopy of arbitrary brain regions with diffraction-unlimited resolving power. In addition, we will miniaturize the setup, opening up the investigation of nanoscale structures in the brain of awake, freely moving and behaving animals. With this, we will be able to correlate for the first time synaptic

structural or organizational plasticity at the nanoscale with behavioural stimuli in a living animal, including for instance in the hippocampus of an animal exposed to a learning situation. Furthermore, these methods will advance the understanding of the interplay between neurons and glia, in particular at synapses, and will help to shed light on brain structure and function in physiological states as well as in disease.

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**NBR: 299288** **ACRONYM: HARMOFIRE** **EC FUND: 209033**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Harmonic Mode-locked Fibre Lasers

**Abstract:** Stabilized mode-locked fibre lasers (MLFLs) are important for a range of applications such as optical communications, frequency metrology, medical imaging, micro machining and femtochemistry. MLFLs are cost-efficient, easy to fabricate, have all-fibre design and high output powers. The key aims of the project are: (a) training of Mrs. Habruseva in the fast growing field of fibre lasers; and, (b) development of cost-efficient stable ultra-fast harmonic mode-locked fibre lasers (HMLFLs) for a range of applications. The interdisciplinary training includes fibre components design, fabrication, advanced modelling and implementation, polarization characterization and communication tests, where the host has a crucial expertise. Tatiana will gain additional expertise and knowledge in applications of fibre lasers, laser technologies and modelling through one-month placements at academic and industrial co-hosts. The multidisciplinary activities include supervision and teaching experience, complimentary courses on the project and knowledge management, research funding, proposal writing, and others. In the first year the Fellow will perform modelling and experimental study of HMLFLs, design and fabrication of fibre optics components, assembling of novel device for polarization control and study of HMLFLs with carbon nanotubes and nonlinear polarization evolution. During the second year the Fellow will study stabilization of HMLFLs. These studies will include research on coupled fibre lasers and development of novel methods for noise suppression. Training outcomes will broaden the Fellow's areas of expertise, enhance her leadership and organisation qualities, and hence will have a great impact on her future career as an independent researcher. Stabilized MLFLs will enable increased performance and reduced complexity of optical networks; they will benefit European community in social, research and economical aspects through contribution to communication technologies.

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**NBR: 299356** **ACRONYM: MAPROMODE** **EC FUND: 168896**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Magnetic Properties of Molecular Deposition: low-temperature MFM and nanocalorimetry of sub-monolayers of magnetic molecules"

**Abstract:** The controlled aggregation of molecule-based materials in confined geometries has opened a new season in nanomaterials research. The present project is ultimately driven by such a fashionable contest. We propose to experimentally study submonolayers of magnetic molecules, deposited on substrates by chemical methods and dip-pen nanolithography (DPN). The ultimate goal is to detect the magnetic signal from grafted molecules, which are of interest for their potential applications in quantum information processing and magnetic microrefrigeration. We plan to use a magnetic force microscope (MFM), working in the (2.8 – 300) K temperature range and in applied magnetic fields. In addition, we will make use of highly-sensitive sub-1 K calorimeters, whose fabrication by micro- and nanolithography is an objective of the present proposal. The magnetic molecules will be directly grafted on the sensing platform of the calorimeters. The proposed activity will be conducted within the consolidated research group "MolChip" (http://molchip.unizar.es/), by making use of the outstanding scientific facilities available at the Institute of Materials Science of Aragón (ICMA) and the Institute of Nanoscience of Aragón (INA).

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**NBR: 299376** **ACRONYM: HIGHSPIN** **EC FUND: 271943**

**DG:** REA **Call: FP7-PEOPLE-2011-IOF** **Thema:** FP7-PEOPLE-2011-IOF

**Title:** Tunable, highly spin-polarised materials for spintronics and non-volatile memories

**Abstract:** The aim of the HIGHSPIN project is to incorporate tunable, highly spin-polarised (THSP) materials into spintronic devices and utilise them in new 2D and 3D nanomagnetic data storage architectures. The field of spintronics, where both the spin and charge of the electron are used, is one of the most rapidly developing and exciting areas of nano-science. The discipline has already revolutionised the information technology industry and further technological applications, from data storage to microwave field generation, make it a hugely worthwhile investigation area. Crucial to all proposed schemes is the efficient creation and control of spin-polarised electric currents. THSP materials offer a means to tailor robust, completely polarised currents. As yet however their use has not been realised in spin transport measurements and spintronic devices. Spin currents offer a fast, low power, electrical means to control magnetic switching which may be scaled along with future device minimisation. They are particularly well suited for emerging classes of 2D and 3D magnetic data-storage, which offer unparalleled densities in fast, low power and non-volatile memories. The project will aim to provide the first demonstration of THSP materials in spintronic devices and develop a working means of pure spin-current mediated data writing in these storage schemes. Fundamentally, the results will greatly further understanding of the role of spin polarisation in spin transport and spin torques on magnetic switching. The initial outgoing phase will draw from the

expertise in advanced materials synthesis and spin transport of the Materials Science department at the University of Minnesota (USA). This knowledge will be well complemented by the return host organisation's (Thin Film Magnetism, University of Cambridge, UK) leading role in 2-D and 3-D nanomagnetic storage architectures and the applicant's experience in high-resolution lithography techniques and nanoscale magnetism.

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**NBR: 299386** **ACRONYM: CELLSTATETRANSITIONS** **EC FUND: 209033**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Capturing transition states associated with lineage decisions in the early mouse embryo

**Abstract:** During early mouse embryogenesis the cells of the blastocyst's inner cell mass take a lineage decision to contribute either to the epiblast or the primitive endoderm (PE). The allocation of cells to either lineage depends on the activity of FGF signaling and two gene regulatory networks (GRNs), one centered on the transcription factor Nanog, the other one relying on Gata factors. The two GRNs are initially activated in an overlapping and heterogeneous pattern in the ICM, and have been proposed to compete each other out over time. The dynamics of this competition, and how the transition state between the two lineages, marked by co-expression Gatas and Nanog, is resolved, is not known. Here I propose to address these questions in vitro by recapitulating the competition between the Gata- and Nanog-GRNs through the controlled overexpression of Gata factors. This converts embryonic stem cells (ESCs), which contribute primarily to the epiblast when introduced in chimeras, into extraembryonic endoderm (XEN) cells, which contribute solely to PE derivatives. I will combine fluorescent reporters with this ES-to-XEN transition to ask with which dynamics transitions occur in individual cells, whether they involve heterogeneities at the population level, and how these parameters are controlled by the activity of gene regulatory networks and signaling pathways. I will aim at identifying culture conditions that stabilize the transition state, where cells might be on the brink of being XEN, and therefore akin to ICM. I hypothesize, that under these conditions cells will be endowed with higher developmental potential compared to parental ES cells, and be able to contribute to both epiblast and PE-derived tissues. The results of this project will enhance our understanding of the mechanisms underlying lineage decisions in early development and may uncover more general principles that govern the way in which differentiating cells are specified in a stem cell pool.

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**NBR: 299400** **ACRONYM: ACCARC** **EC FUND: 192622**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Engineering of an Artificial Capsidic Enzyme for Aqueous Dirhodium Catalysis

**Abstract:** Artificial metalloenzymes are expected to bring together the best of the two worlds of homogeneous and enzyme catalysis, combining broad substrate scope with high activity and reaction selectivity under mild conditions. Herein we propose to construct an artificial metalloenzyme based on a dirhodium active site in the capsid scaffold of the protein ferritin. Catalytically competent dirhodium compounds are derived from dirhodium tetraacetate, which possesses fourfold symmetry, with the ligands symmetrically arranged around the equator of the rhodium dimer. The transition metal core is active in a wide range of reactions including cyclopropanation, C-H activation and O-H insertion. These transformations play an important role in the synthesis of natural products, pharmaceuticals, and other industrially relevant targets. We will exploit the fourfold-symmetric pores of the capsidic protein ferritin to construct a dirhodium binding site. A ferritin mutant will be produced with four glutamate residues pointing in the channel lumen, suitable as ligands for the rhodium dimer. After derivatization with dirhodium the artificial capsid will be employed as a catalyst in organometallic reactions, such as the cyclopropanation of diaza carbonyl compounds with olefins in aqueous solution. The catalytic properties of this first dirhodium enzyme will be fine-tuned by the highly modular secondary ligand environment of the protein. The dirhodium binding site will also be introduced at the inner mouth of the fourfold channel, resulting in an active site inside the capsid. High local substrate concentrations and the presence of a second, complementary reaction center inside the capsid might allow multi-enzyme cascade catalysis, thus paving the way toward artificial nanoreactors with tailored properties.

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**NBR: 299490** **ACRONYM: F-LIGHT** **EC FUND: 200978**

**DG:** REA **Call: FP7-PEOPLE-2011-IOF** **Thema:** FP7-PEOPLE-2011-IOF

**Title:** FÃ¶rster resonant energy transfer for high efficiency quantum dot solar cells

**Abstract:** The Project F-LIGHT aims at exploiting in innovative way the Förster resonant energy transfer (FRET) process in excitonic solar cells, by adding proper donor/acceptor (D/A) couples, which lead to broadening of the absorption spectral range and improve the photoconversion efficiency. The D/A couples are composed of commercially available dye molecules and colloidal and non-colloidal quantum dots (QDs). The investigation takes advantage of the outstanding injection properties of commercially available dye molecules and naked QDs generated by successive ionic layer absorption and reaction (SILAR), while benefiting of the outstanding stability and high electric insulation of suitably passivated colloidal QDs. The first ones act as donors strongly attached to the photoanode, the second one acts as acceptor systems to expand the absorption band. One further fundamental idea is the chemical bonding inside the D/A pair, to enhance FRET probability and optimize surface occupancy by the acceptors. Key point of the Project will be the in depth investigation of the structure, electrical and optical

properties of the nanostructured heterointerfaces between the D/A couples and the photoanode by applying advanced techniques (SPM, STS, PEEM, TRPL) all available at the outgoing host Institution. Expected results can give concrete contribution to overcome the intrinsic limits of the state of the art excitonic cells, allowing exploitation of all their potential, whose efficiency is not limited by the Queisser limit and could be as high as 45%. The applicant will be trained on techniques not currently in his background (SPM, STS, TRPL), and whose application represents significant step forward the comprehension of the physico-chemical mechanisms of FRET in excitonic solar cells. Strong synergistic activities are planned between the incoming and outgoing hosts, aiming at setting up durable scientific collaboration as one of the main outcome of the Project, after the reintegration phase.

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**NBR: 299517** **ACRONYM: PECQDPV** **EC FUND: 176053**

**DG:** REA **Call: FP7-PEOPLE-2011-IIF** **Thema:** FP7-PEOPLE-2011-IIF

**Title:** PLASMONICALLY ENHANCED COLLOIDAL QUANTUM DOT PHOTODETECTORS AND PHOTOVOLTAICS

**Abstract:** Colloidal quantum dots (CQDs) have recently attracted significant attention as a candidate material for optoelectronic devices, and in particular photodetectors and solar cells. These materials can be manufactured in the solution phase and spin-cast onto a variety of substrates, significantly reducing the cost of device fabrication. Additionally, the bandgap of CQD films can be tuned to allow absorption of specific wavelength regions by varying the diameter of the CQDs, due to the quantum confinement size effect. To maintain efficient charge extraction in these devices, the thickness of the CQD layer is restricted, resulting in devices that are limited by non-complete absorption. To improve efficiencies it is necessary to decouple the optical thickness from the electrical thickness by employing novel light-trapping schemes. Plasmonics offers the opportunity to confine light in sub-wavelength volumes, increasing the absorption in thin films. Discrete metal particles can be fabricated on a glass substrate, by simple self assembly or by nano-fabrication techniques, before the CQD are spin cast thus allowing plasmonic scattering structures to be incorporated into the cells without significantly increasing the complexity or cost of cell fabrication. By integrating plasmonic light trapping based on sub wavelength scattering structures with CQD devices, we will aim to dramatically increase the absorption, while maintaining good electrical characteristics, and hence achieve gains in overall performance and efficiency. Additionally, we will study the physical mechanisms behind plasmonic enhancement by employing FDTD simulations to investigate the scattering behaviour of single particles and periodic arrays embedded in CQD films, and combine this with simple conceptual models to design optimal scattering structures. These will be fabricated on CQD devices with the aim of providing the maximal absorption enhancement possible with plasmonic structures.

**NBR: 299525** **ACRONYM: MIRNANO** **EC FUND: 191675**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Toxicogenomic studies on engineered carbon nanomaterials

**Abstract:** Engineered nanomaterials (ENM) are becoming an issue of great concern regarding their health effects. Different types of ENM are being used today in everyday consumer products as well as professional equipment such as medical devices. Several ENM, even those used in products that are already on the market, have been shown to be cytotoxic, genotoxic and immunotoxic in experimental settings, but knowledge is still too scarce and inconsistent for efficient and accurate risk assessment on ENM exposure and the materials are still classified according to the toxicity of their respective bulk material. Carbon nanotubes (CNTs) are among the most utilized ENM and studies have indicated that certain types may have similar health effects as the well-known human carcinogen, asbestos. The toxic effects of CNTs have been investigated at several levels, but the genetic mechanisms behind these effects are still largely unknown. Toxicogenomics investigates the multifaceted genomic responses to xenobiotic substances in biological systems on a genome-wide level. Thus, toxicogenomic studies may reveal the genomic changes related to CNT exposure and may give insight into the mechanisms behind their hazardous effects. In this study genetic features such as mRNA and microRNA expression changes as well as histone modification patterns will be profiled on a genome-wide level in a bronchial epithelial cell line following exposure to various carbon nanomaterials, including CNTs. Asbestos will be used as a positive control. This will enable the identification of early genomic changes which may elucidate the mechanism of action behind the cellular responses to these ENM and possibly reveal eventual toxic outcomes following exposure. Furthermore, the results are anticipated to lay a foundation for accurate risk assessment of CNTs.

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**NBR: 299527** **ACRONYM: LH-NAN-LC** **EC FUND: 201932**

**DG:** REA **Call: FP7-PEOPLE-2011-IIF** **Thema:** FP7-PEOPLE-2011-IIF

**Title:** Luminescent Hybrid Nanomaterial showing liquid crystalline properties

**Abstract:** In recent years the growing awareness of the merits to use renewable energies as well as the high oil prices have led to a new approach in the use of liquid crystal materials. One of their main applications is the LCD screens. In order to minimize the energy consumption of such devices, new arising technologies based on organic light emitting diodes (OLEDs) are now used in the design of flat low-power display. However this

technology can be improved by replacing the amorphous emitting organic compounds by stable inorganic phosphors showing liquid crystal properties. The “Luminescent Hybrid NANomaterial showing Liquid Crystalline properties” project proposes to develop such approach by introducing a bright red-NIR inorganic emitter in a liquid crystal matrix. The one nanometer sized octahedral clusters based on Mo6 or Re6 scaffolds have been chosen for their outstanding luminescence properties. These inorganic building blocks are obtained via solid state chemistry synthesis techniques and, once solubilized, can be functionalized with judiciously designed organic molecules to give hybrids nanomaterials with self-organization abilities. This two years project will contribute to maintain Europe’s leading position in the field of innovative materials technologies for the future by developing new multifunctional nanomaterial with tailored properties: the clustomesogens (liquid crystal based clusters). Although at a first glance, the work is of peculiar interest to academics from a range of backgrounds, in particular to supramolecular, coordination, solid state and material chemists as well as physicists, there is a considerable industrial and commercial potential in the medium and long term as stated in the SusChem Strategic Research Agenda. The researcher involved in this proposal will brought his skills to consolidate and maintain the worldwide leadership position of the host group in the field of luminescent nanohybrid materials based on metallic cluster core.

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**NBR: 299598** **ACRONYM: HABER** **EC FUND: 209033**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Hybrid approaches to bone regeneration

**Abstract:** The aim of the proposed project is to produce a new generation of hybrid materials that heal bone defects, reduce the need for transplants, improving quality of life for trauma and cancer patients and the elderly. The new materials will share load with bone, stimulate bone growth and dissolve after the bone is repaired. They will also be able to be cut to shape by a surgeon in theatre. Current bionert implants have a limited lifespan, which is a major problem for traditional materials as human life expectancy continues to increase. Therefore, this project aims to shift emphasis from replacement of tissues to regeneration of tissues to their original state and function. In this proposal new bioactive organic-inorganic hybrids will be created that could, for the first time, fulfil all the criteria for an ideal scaffold. Hybrids are a new way to obtain synergy from materials, where the organic is introduced while the inorganic network is being assembled so that the components interact at the molecular level. The key to success is using polymers that have not yet been exploited for construction of bone scaffolding materials. This is because the degradable polymers that are currently approved for biomedical applications (e.g. polyesters) degrade and lose their mechanical properties too rapidly once degradation begins. Alternatives are naturally occurring polymers that are enzyme degradable and can therefore degrade by natural remodeling mechanisms

after implantation. Also key is obtaining controlled covalent bonding between the organic and inorganic components. In addition nanoscale texture will be introduced on the scaffolds surface by the incorporation of polyhedral oligomeric silsesquioxanes nanostructures, which are non toxic, biocompatable can promote faster osseointegration and provide in situ mechanical stability to the scaffold. In this way the proposed hybrid scaffolds will be optimized from the surface topology to the nano and macro scale.

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**NBR: 299600** **ACRONYM: 1MOLECULENEARPLASMON** **EC FUND: 183805**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Single-molecule spectroscopy in the near field of plasmonic metal nanoparticles

**Abstract:** Our project is to combine single-molecule spectroscopy with plasmonic nanomaterials. We will use the fluorescence excitation lines of single molecules in a cryogenic experiment to probe the local field enhancement of single plasmonic antennas, as well as of periodic array of antennas. At low tem-peratures, spectral selection will enable us to address a large number of molecules (typically 100,000) independently in each focal spot, by tuning the excitation laser. Thereby, we will determine the position of the excited molecule by superresolution techniques and correlate it with its emission properties. The linewidth and saturation fluorescence intensity of each molecule will be used to determine the local field enhancement. By selecting many individual molecules, we will map the local field and the associated enhancement of the molecular emission. Compared to previous experiments, this method is non-invasive, non-destructive, and still provides high spatial resolution. The local-field map will be used for further optimization of the nanoantennas in collaboration with a group in charge of the nanofabrication. The optimized antennas will allow us to enhance light-matter interaction and eventually, to manipulate single photons with single molecules.

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**NBR: 299636** **ACRONYM: PINSYS** **EC FUND: 209033**

**DG:** REA **Call: FP7-PEOPLE-2011-IIF** **Thema:** FP7-PEOPLE-2011-IIF

**Title:** Bio-Inspired Approaches to Porous Inorganic Nanoparticles and Their Application as Targeted Drug Delivery Systems

**Abstract:** This project will develop novel, bio-inspired routes to the synthesis of porous inorganic nanoparticles with sponge-like internal structures, using nanostructured polymer capsules as templates. The application of these structures in targeted drug delivery and controlled release will then be investigated. Biominerals provide a unique inspiration for

the design and synthesis of new materials. While showing remarkable structures and properties, these amazing materials form in aqueous environments under ambient conditions and organic molecules – either as soluble additives or insoluble matrices – are used to control crystal growth. We will here employ a bio-inspired strategy to generate porous calcium carbonate and calcium phosphate nanoparticles with sponge-like structures. A novel class of polymer capsules with bicontinuous internal structures, which are formed by the self-assembly of comb-like block copolymers in water will be used as templates. This system will also provide a unique opportunity for studying the effect of confinement on crystal nucleation and growth. Crystallisation in confinement is widespread in Nature, the environment and technology, and the research will therefore impact on fundamental research and technology across many disciplines. The synthesised porous nanoparticles will then be used to build targeted drug delivery systems (DDSs) by encapsulating anti-cancer drugs for the treatment of bone cancer. While mesoporous silica nanoparticles have been investigated quite extensively, little work has to-date been performed on alternative nanoporous crystalline inorganic nanoparticles. As compared with mesoporous silica, the calcium phosphate and calcium carbonate nanoparticles will show superior biocompatibility and biodegradation, and will also offer acid-responsive solubility and therefore will give the pH-responsive release of the encapsulated drugs from the drug delivery system in the acidic environment of tumors.

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**NBR: 299726** **ACRONYM: NADETOX** **EC FUND: 183805**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** NAnomics in vitro DEvelopmental TOXcology

**Abstract:** The progress made in improving the development and the production of nanoparticles (NPs) is enormous. Metallic nanoparticles (mNPs) are among the most widely used types of NPs in electronics, foods, containers, pharmaceutical drugs, cosmetics and paints. This trend will lead to an ever-increasing presence of NPs in the environment. This scenario means that humans and the environment will be exposed to more and more nanotechnology-based products whose health risks and environmental impacts of NPs might outweigh their benefits. In order to promote prevention and safety in manufacturing and handling of NPs, NADETOX aims at evaluating the nanodevelopmental toxicity of selected metallic cobalt, silver and gold NPs extensively used in nanomedicine for cancer therapy. This novel and multidisciplinary research project is based on the 3Rs in vitro approach (Reduction, Refinement, Replacement), involving the development of a mechanistically-based alternative method, Frog Embryo Teratogenesis Assay-Xenopus (FETAX), and the combined use of peculiar advanced spectrochemical, radioanalytical, biochemical and molecular biology techniques. These methods offer the opportunity to label NPs, avoiding surface modification, to localise and quantify them in organisms. NADETOX aims at the following goals: (i)

characterisation of NPs establishing their size and morphology, (ii) study of stability and of the eventual release of metal ions from radiolabelled NPs in the reconstituted water medium suitable for the culture of Xenopus embryos (FETAX medium), (iii) evaluation of embryolethality and teratogenicity of NPs by FETAX assay, (iv) biokinetics studies to measure uptake, metabolic fate and biopersistence of NPs in Xenopus at embryo and larva stages and structure diagnosis at DNA level, to get information on the genomic stability following formation of DNA-adducts.

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**NBR: 299818** **ACRONYM: PHOTOCATMOF** **EC FUND: 209033**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Dye-Sensitized Metal-Organic Frameworks for Photocatalytic Water Splitting

**Abstract:** This project is proposed to enhance hydrogen generation form metal-organic frameworks (MOFs) for photocatalytic water splitting via dye sensitization. Solar energy-driven renewable hydrogen could transform the supply of carbon free fuel and make an enormous impact on the viability of hydrogen as an energy carrier. Secondary building units (SBUs) in MOFs are typically comprised of transition metal oxide/nitride coordination units that can be considered as semiconductor quantum dots and thus MOFs are regarded as a matrix of such quantum dots. Although MOFs have exhibited the photocatalytic activity for water splitting, the apparent quantum yield is low because of large band gaps of SBUs. Suitable dyes are employed to sensitize the SBU semiconductor quantum dots via post-synthetic modification to enhance the capability to capture visible light, by integrating the concept of dye-sensitized semiconductor into MOF-based photocatalyst. Porosity of MOFs makes it possible to adsorb water molecules inside of free pore space which is expected to capture photoinduced electron for hydrogen generation. This system is well suited for the mechanism study due to the self-containing water molecules. In contrast, water can only be adsorbed on surface of the dense bulk semiconductor via weak interaction. This project stands at the intersection between MOF chemistry and semiconductor science. MOF provides a semiconductor quantum dot matrix and they are stable and free from agglomeration due to the strut of organic linkers, which is the drawback of for bulk and nanosized semiconductor materials. And the quantum effect of SBUs will play a great effect for the photocatalytic performance. Dye sensitization of MOFs fully adopts the merits of both MOF and semiconductor and overcomes their respective drawback for photocatalysis. The scientific and technological strengths identified between the researcher and host, Professor Rosseinsky, University of Liverpool is well aligned to the project.

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**NBR: 299855** **ACRONYM: MESCD** **EC FUND: 177000**

**DG:** REA **Call: FP7-PEOPLE-2011-IIF** **Thema:** FP7-PEOPLE-2011-IIF

**Title:** Tuning of the mechanical and electronic properties of graphene by strain, chemical doping and defects

**Abstract:** The mechanical properties of graphene, the thinnest material in the world, will be investigated theoretically. This project will focus on the basic and advanced mechanical properties that are potentially useful for controlling: i) the strain distribution, ii) the band gap, and iii) the observation and visualization of electronic polarization in single/multilayer graphene. The theoretical approaches will be based on large scale classical atomistic simulations and density functional theory methods. An essential part of the proposal is the transfer of knowledge to the host organisation by means of research on very timely topics. The candidate will provide hands on knowledge transfer on state of the art Molecular Dynamics simulation method for obtaining thermo-mechanical properties of large scale graphene flakes, electronic band structure calculations of nanostructured and chemically modified graphene flakes, Quantum Monte Carlo calculations for studying many electron graphene quantum dots, and providing the required input data for tight-binding calculations.

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**NBR: 299925** **ACRONYM: TWO-STRAND** **EC FUND: 200371**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Linear and cyclic double-strand molecular wires

**Abstract:** This project will focus on double-strand nanowires and nanorings consisting of butadiyne-linked porphyrin oligomers. One objective is to create double-strand linear conjugated polymers with useful nonlinear optical properties for ultrafast all-optical communication systems. Another objective is to explore a new approach to template-directed synthesis, whereby one nanoring acts as a template to direct the construction of a second complementary nanoring. Double-strand porphyrin nanorings are of high interest because of their resemblance to photosynthetic light-harvesting complexes. They are also expected to have interesting nonlinear optical properties. Professor Anderson is a leading expert in supramolecular chemistry and the engineering of molecular wires. The Department of Chemistry at Oxford is one of the top chemistry departments in Europe with outstanding research facilities. Christiane Knappke recently completed her PhD at the University of Cologne in the field of N-heterocyclic carbene chemistry. During her PhD work, she synthesised some remarkable electron-rich pi-systems. This experience made her eager to learn about the synthesis and characterisation of larger functional pi-systems. Anderson's group provides an ideal environment for gaining this expertise. This project will provide her with high-level hands-on training in supramolecular chemistry, template-directed synthesis, electrochemistry, photophysical techniques and EPR spectroscopy. She has the

necessary expertise to make fast progress with the project, and to rapidly acquire new skills. This fellowship will put her in a very strong position to start an independent research career. The project includes collaborations with physical chemists, physcicists and materials scientists, located in Oxford and other EU-countries. The fellow will be fully engaged with these collaborations. This contact will add a valuable dimension to the training while increasing the scientific impact of the project.

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**NBR: 299957** **ACRONYM: DISCANT** **EC FUND: 209033**

**DG:** REA **Call: FP7-PEOPLE-2011-IIF** **Thema:** FP7-PEOPLE-2011-IIF

**Title:** High-energy dissipative soliton dispersion-managed fibre laser based on carbon nanotubes

**Abstract:** The proposed research program aims at knowledge transfer from a Fellow with strong expertise in mode-locking fibre lasers using carbon nanotubes to the EU host who can combine this knowledge with own expertise in soliton theory and dispersion management for advancing the fast growing field of fibre lasers. The overall research objective is to develop new concepts, techniques and approaches to the new design of high-energy fibre lasers based on a transfer of the methods of nonlinear science into the field of optical engineering. The proposed interdisciplinary project will link optical engineering laser research to applied mathematics, nonlinear wave physics and nano-material physics. The academic profile of the applicant ideally matches the proposed research project. Dr. Webb as a host will supervise the experimental research in the project and Prof. Turitsyn as a co-supervisor will coordinate theoretical studies on dispersion-managed dissipative soliton fibre lasers. The project is split into four distinct work packages (WPs) targeting four types of research goals and corresponding knowledge transfer. • WP1 targets fundamental properties of fibre laser systems. • WP2 will create a platform for fabrication of carbon nanotube saturable absorbers for photonic applications. • WP3 will focus on demonstration of advanced practical high-energy fibre laser systems. • WP4 will aim to optimize noise performance of the laser systems and broaden their operating wavelength range. The proposed interdisciplinary program will make important contributions both to science and technology and European excellence and competitiveness, namely, the project: • will enhance EU research in laser science, optical communications and nonlinear photonics; • will establish an internationally leading position for EU in the science, application and production technologies of fibre lasers; • will lead to a new level of high-brilliance laser sources important for a range of applications.

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**NBR: 300011** **ACRONYM: BIOMUC** **EC FUND: 280017**

**DG:** REA **Call: FP7-PEOPLE-2011-IOF** **Thema:** FP7-PEOPLE-2011-IOF

**Title:** Mucin binding to bioactive molecules: physiological role and new biomaterials

**Abstract:** Mucins are high molecular weight glycoproteins, responsible for most of the extraordinary properties of the mucosal layer, which covers around 300 m2 of our body's surface. Mucins have mostly been studied in the context of their physiological role: for their ability to protect the epithelial layer from viral and bacterial infection, oxidative degradation, dehydration and mechanical stresses. They are also of major importance in cancer biology, where altered mucin secretions are recognized as cancer markers. A few studies have focused on the interactions of "objects" expected to diffuse from the exterior to the interior of the body through mucin gels, such as nutrients, antibodies, viruses and bacteria. This proposal describes how we will study the ability of mucin to sequester bioactive molecules secreted by cells surrounded by mucin. The goal is to investigate whether mucin gels can be a reservoir for bioactive molecules in a similar fashion to what the extracellular matrix is now recognized to be. The proposal describes a three-phase approach, which will both advance our knowledge on the physiological role of mucin gels and will lead to the development of innovative mucin-based biomaterials for drug delivery and tissue engineering applications. The first phase will focus on using 2D mucin coatings to study mucin interactions with relevant bioactive molecules. Also, structure/function will be investigated by modifying mucin chemistry. During the second phase, we will build multilayer thin films of hundreds of nanometer thick using lectin proteins as cross-linker between the mucin layers. The films will be characterized and their ability to act as a reservoir for drugs and other bioactive molecules will be assessed. Finally, in the return phase, we will combine the return host's expertise on natural based polysaccharide gels, and the knowledge accumulated on mucins. In particular, 3D hydrogels comprising mucin will be developed as a new biomaterials.

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**NBR: 300027** **ACRONYM: ORBITAL IMAGING** **EC FUND: 200041**

**DG:** REA **Call: FP7-PEOPLE-2011-IIF** **Thema:** FP7-PEOPLE-2011-IIF

**Title:** Electron orbital resolution in scanning tunneling microscopy

**Abstract:** Scanning Tunneling Microscopy (STM) has become one of the basic techniques for the analysis of surface reconstructions, overlayer growth mechanisms, surface dynamics and chemistry at the atomic scale. STM is used in physics, chemistry and biology for investigation of organic and inorganic nanoobjects. However, the mechanisms of STM image formation are still not completely understood. The proposed project will be focused mainly on two unresolved issues. The first research focus is related to fabrication of functionalized STM probes with well defined electronic (orbital) structure. To control the electronic structure of the STM tip apex, oriented single crystal probes

will be used. The second research focus is related to experimental and theoretical studies of the STM tip and surface atoms interaction and the role of different electron orbitals of the both tip and surface atoms in the STM image formation process. The atom-atom interaction at extremely small tunneling gaps as well as distance and bias voltage dependent contribution of separate electron orbitals will be studied experimentally using scanning tunneling microscopy and spectroscopy at room and low temperatures. The experimental data will be analyzed in a conjunction with results of theoretical (density functional theory and tight binding) calculations. The project activity can provide new fundamental understanding of the atomic scale objects and give some keys for controllable probing separate electron orbitals of individual atoms with STM. This can advance the surface analysis methods necessary for development of nanoscience and nanotechnology. The selective orbital imaging capability can allow to reach ultimate spatial resolution, spin sensitivity at the atomic scale and controllable chemical discrimination of atomic species on surfaces using STM that are essential for physics, chemistry, biology, medicine and materials science.

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**NBR: 300036** **ACRONYM: GRAFIEST** **EC FUND: 224462**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Graphene-Ferroelectric Interface for Electronic and Spintronic Technologies

**Abstract:** Graphene is a perfect infinite single layer of sp2-bonded carbon atoms densely packed into a benzene-ring structure. The confinement of electrons in two dimensions and the peculiar symmetry of the carbon network give graphene exceptional electronic properties that make it a promising material for carbon-based nanoelectronics and spintronics. In particular, the performances of such devices rely on the exceptional intrinsic carrier mobility of graphene. However, extrinsic scattering sources due to standard SiO2 substrates limit the mobility. Hence, the quest for alternative substrates is mandatory in order to increase the mobility beyond the extrinsic limits. Among the possible candidates, ferroelectric (FE) substrates are the most promising due to their ultrahigh dielectric constant and hysteretic dielectric response to an electric field (Objective 1). In addition, periodic polarization domains can be written in FE materials, resulting in a substrate with tunable periodic potential that would allow the engineering of the electronic properties of graphene without etching (Objective 2). Further, a magnetic FE (magnetoelectric, ME) substrate can induce magnetism in graphene and can transfer the ME properties to the graphene itself, hence allowing for electrical control of magnetism in graphene (Objective 3). The three Objectives of the present Proposal concern the theoretical investigation of these new hybrid graphene-FE and graphene-ME systems. Unveiling the properties of graphene-FE and graphene-ME interfaces is a fundamentally important first step towards the development of novel nanoelectronic and spintronic devices. In order to achieve the accuracy needed to capture the fine physical details and due to the nanoscopic scale of the systems to be

studied, quantum-mechanical computations with atomic resolution are necessary. Hence, first-principles techniques based on Density Functional Theory (DFT) are the method chosen to address the proposed objectives.

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**NBR: 300193** **ACRONYM: MPIS-FET** **EC FUND: 278807**

**DG:** REA **Call: FP7-PEOPLE-2011-IIF** **Thema:** FP7-PEOPLE-2011-IIF

**Title:** Metal-Piezoelectric-Insulator-Semiconductor Field-Effect-Transistor for high temperature pressure sensing applications

**Abstract:** This project, entitled 'Metal-Piezoelectric-Insulator-Semiconductor Field-Effect-Transistor' (MPIS-FET), will fabricate a metal-piezoelectric-insulator-semiconductor field-effect-transistor device for pressure sensing, in order to perform high-sensitivity strain detection (gauge factor>100) under harsh conditions (high temperature>500oC). High-temperature pressure sensors are of extreme importance for automotive, aerospace, aircraft, power generation industry, and scientific instruments. The current pressure sensors suffer from various drawbacks such as poor thermal stability, low sensitivity, poor chemical inertness, high complexity in readout circuit, and high cost. This project will bring a very talented researcher (Dr Meiyong Liao) from one of the world leading research institutes (National Institute for Materials Science, NIMS, Japan), specializing in the diamond doping, etching and sensor fabrications, to work with a leading Nanoscience Research Group (NRG) at Aston University (UK), specializing in diamond sensors and power devices, with a combined expertise to address the specific challenge described above. The project will transfer the skills and knowledge from one of the world leading Japanese institutions to the Europe through the Marie Curie International Incoming Fellowship Scheme. The proposed novel pressure sensor will contribute to the aerospace, automotive, and industrial society of Europe.

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**NBR: 300230** **ACRONYM: DENDRIMMUNEASSAYS** **EC FUND: 168896**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Development of sophisticated dendrimeric nanostructural materials with potential applications in drug allergy diagnosis: Towards immunoassays and cellular tests (basophil activation tests).

**Abstract:** Nowadays drug allergy is considered a major public health problem in developed countries. Its correct diagnosis is very important for the adequate prescription of drugs to avoid risks for the patient. However, the adequate diagnosis is in certain cases difficult to address. This research aims at the development of sophisticated

nanostructural materials with potential applications in drug allergy diagnosis. To this, the study will first focus on the identification of drug antigenic determinants still unknown by using different drug models as those derived from diclofenac and clavulanic acid, by a synthetic strategy to the hypothesized molecules and subsequent clinical evaluation. Secondly we propose the design of dendritic molecules displaying multiple presentations of relevant drug antigenic determinants. The determinants identified in the objective above and others already known as amoxicillin, will be coupled to the periphery of dendrimers and/or dendrons with the adequate methodology. The molecular recognition of these structures by specific IgE antibodies will be evaluated by radioimmunoassays, and performances in the structures will be carried out up to reach an optimal recognition. The final well-recognized structures will be anchored onto a solid phase with the aim of developing drug allergy diagnostic kits, to use in a routine clinical practice. Other approaches towards the study of the optimal distance in crosslink-IgE to produce the basophil activation will also be addressed in order to increase the sensitivity of this test. Biocompatible dendrimer as scaffolds, click chemistry methodologies, solid phases, organic chemical design will be used for the development of this project, with an important support of clinical evaluation and a biobank with patients sera. This methodology is expected to deliver a new tool box for the design of sophisticated nanostructural materials and versatile to the diagnosis of allergy to different drugs towards a microarray.

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**NBR: 300302** **ACRONYM: NANOSTAB-GB** **EC FUND: 232339**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Novel Nano-Stabilisation for Green Bioplastic Nanocomposites

**Abstract:** The primary focus of NANOSTAB-GB (Novel NanoStabilisation for Green Biopolymer-Nanocomposites) is on developing innovative technology for enhancing processability, performance and durability of sustainable green biopolymer-based nanocomposite materials. The underpinning science is a novel chemical process for the immobilisation of protective agents onto natural nanoscopic-size reinforcing fillers embedded in biodegradable and compostable polymers. The novel chemistry developed here will be technologically relevant and industrially viable for production of durable structured biodegradable nanocomposites with direct involvement (in project and training) of leading European producer. One challenging demand in materials research today is that of the development of advanced materials based on sustainable resources as alternatives to fossil fuel-based materials. Current biopolymer-clay-based nanocomposites have the potential to meeting this demand competitively but only when new technological breakthroughs emerge to overcome major short- and long-term performance problems of stability during high temperature manufacture and in-sevice. The scientific goal of NANOSTAB-GB is to bring about step-change development in a technology platform which is readily scalable by implementing 'smart' stabilisation

approaches for modifying nanoparticles and building biopolymer-nanoparticle reinforcing networks structured around naturally-occurring, bio- or synthetically- based antioxidants. Results generated will be disseminated globally; the outcome of NANOSTAB-GB addresses directly the EU vision of 'Knowledge Based Bio Economy'. IP generated will help maintain EU lead on 'green' materials and to meeting CO2 emission targets. Above all, it will provide an inspirational training opportunity for a talented fellow with assured successful outcome benefitting both fellow and EU with the emergence of a multi-skilled leader in biomass-based materials research with sustainability at its core.

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**NBR: 300324** **ACRONYM: MCIBC** **EC FUND: 200371**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Molecular characterization of the interaction of Î² -2 microglobulin with collagen

**Abstract:** β -2 microglobulin (β-2-m) is a 99 residue protein with an immunoglobulin fold. β-2-m is usually found as a part of the major histocompatibility 1 complex. This protein aggregates to form amyloid fibrils in osteoarticular tissues, leading to pathological bone destruction and the condition known as dialysis-related amyloidosis (DRA). The accumulation of β-2-m deposits has been shown to cause arthralgias, destructive osteoarthropaties and carpal tunnel syndrome. The host laboratory has characterized β-2-m amyloid assembly and developed a molecular description of the folding and aggregation mechanisms of β-2-m under relevant conditions, but the factor or factors responsible of the initiation of the aggregation process are still unknown. β-2-m amyloid accumulates in connective tissue, causing the pathological consequences of the disease. Collagen is one of the main components of this tissue and has been proposed to be a possible contributing factor in the initiation of aggregation. Consistent with this, studies with ex vivo amyloid material show that there is a strict association between β-2-m and collagen within joints, while biochemical experiments have revealed tight binding between β-2-m and collagen. This project will focus on the study of the interactions between collagen and β-2-m and its consequences for the formation of amyloid fibrils from a molecular viewpoint. We will study the specificity of interaction of β-2-m with different collagen sequence patterns and the influence of collagen on β-2-m stability, dynamics, and aggregation rate. For this project a complementary set of biophysical techniques, including mass spectroscometry, NMR, fluorescence, infrared spectroscopy and electron microscopy, will be used. The results will facilitate the design of small molecules or nanoparticles (copolimer, dendirmers) directed to interfere with the interaction of β-2-m with collegen as a route toward prevention of β-2-m fibrillization.

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**NBR: 300390** **ACRONYM: NANOBIOMOFS** **EC FUND: 168896**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Nanoscale Metalâ€"Organic Frameworks for Biomedical Applications

**Abstract:** The project NanoBioMOFs (Nanoscale Metal–Organic Frameworks for Biomedical Applications) is a step forward to the researcher's work undertaken during his postgraduate studies which comprised synthesising bulk Metal–Organic Frameworks (MOFs) for applications in gas storage, gas and liquid separation and molecular sensing. MOFs can be obtained from the connection of metal centres and organic ligands through the space in such a way that the structures obtained can be extended in one–, two– or three–dimensions. The applicant wishes to extend his knowledge in the same research area but from a completely different viewpoint, synthesising MOFs at the nanoscale regime for applications in drug delivery. To date, nanoparticle systems (polymer, iron or gold nanoparticles) have been used as drug delivery agents. This methodology has attracted much attention as it can improve many of the drawbacks of conventional therapy including high doses, rapid clearance, poor pharmacokinetics and strong side effects. Porous MOFs can be also used as drug delivery carriers due to their tunable host–guest properties and the ability to post–modify their internal surface. Although MOFs are excellent candidates to deliver drugs, they cannot be used in the form of traditional bulk but they have to be miniaturized at the nanometre scale. The aim of this project will be the synthesis of known and novel biocompatible, water–resistant MOFs based on biological ligands at the nanoscale, loading of MOFs with anticancer drugs and check their in vitro safety and therapeutic efficacy for chronic diseases such as cancer. This project allows the applicant to conduct truly interdisciplinary and inter–sectoral research, complementing his expertise in synthetic and materials chemistry in nanotechnology (Catalan Institute of Nanotechnology) and biomedicine (Biotechnology and Biomedicine Institute) at laboratories with long–standing collaboration, unique validation models and and state–of–the–art infrastructure.

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**NBR: 300402** **ACRONYM: HYBROQUBITS** **EC FUND: 200371**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** developing hybrid organic-inorganic rotaxanes for quantum information processing

**Abstract:** The proposed project is based on recent results reported (Nature 2009, 458, 314; J. Am. Chem. Soc., 2010, 132, 15435) by the Winpenny group where they showed that heterometallic rings could be grown around organic threads, producing a new form of rotaxanes with both inorganic and organic components. [3]rotaxanes could be made as prototypes for two qubit gates for quantum computers. Quantum computers will use quantum binary digits, or qubits (the quantum analogue of the classical bit). Their

complexity will enable to perform calculations with speeds of millions of times faster than the average PC. A key question is how to link qubits to entangle spins without causing decoherence; The Winpenny group et al. showed that using organic and inorganic components at the molecular level, they could link two molecular nanomagnet prototype qubits into a structure where, depending on the link, they can either communicate or not (Nat. Nanotech. 2009, 4,173). Here we suggest an innovative proposal to build two qubit rotaxanes that could become part of future devices. [3]rotaxane provides the ideal framework for making a scalable two qubit gate, because we can develop the two components of the rotaxane separately and then combine in the final structure. We use the thread to control the through space inter-ring interaction to study the control of coherence times and simultaneously, we will design a "communication strap" through performing chemistry on the rings. Substitution chemistry allows us to include within the rings and stoppers groups that can bind to other metal ions, or surfaces. Physical studies will be made with pulsed EPR spectroscopy both in ground and excited states to measure relaxation times, varying factors like solvent that can influence relaxation times. The advantages over other solid state systems: chemistry is cheap and reliable allows multiple chemical functions to be incorporated heterometallic rings can involve multiple qubits

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**NBR: 300411** **ACRONYM: HELIPORE** **EC FUND: 209033**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** DNA sequencing using helicase-modified alpha-hemolysin nanopores

**Abstract:** Most of the current, second generation, methods for DNA sequencing are based on alternating cycles of enzyme manipulation and imaging the incorporation of fluorescently labeled nucleotides. These methods, however, hold several disadvantages, mainly the long duration of each sequencing experiment and the requirement for fluorescently labeled nucleotides and primer sequences. Tremendous efforts have been taken in order to develop cheap and ultra-fast sequencing systems. Specifically, the sequencing of single DNA molecules is of great importance, as no pre-amplification step and no labeled nucleotides are required. I intend to use biological nanometer-scale pores (alpha-hemolysin) modified with a DNA manipulating enzyme, a helicase, embedded in a membrane that separates two compartments, each contains an Ag/AgCl electrode, for the sequencing of single DNA molecules. Based on previous results, I expect that the ionic current, associated with DNA translocation through the nanopore, will exhibit a specific pattern for each nucleobase, allowing sequence determination. I intend to construct two different systems, in the first system the helicase will be soluble in the cis compartment, whereas in the second configuration the helicase will be attached to the nanopore via double stranded DNA linkers. The helicase enzyme will unwind double stranded DNA, form a ratchet-like movement of the DNA strand through the pore and control the pace of DNA translocation, leading to efficient sequencing.

**NBR: 300501** **ACRONYM: ENERGOSIL** **EC FUND: 377209**

**DG:** REA **Call: FP7-PEOPLE-2011-IOF** **Thema:** FP7-PEOPLE-2011-IOF

**Title:** Silicon Films on Metals for Energy Applications

**Abstract:** The main objective of this project is creation of porous silicon films with effective light absorbance on technically important metallic substrates such as steels, aluminium alloys and copper as well as metal-coated glass. This will give the possibility of combining structural materials with silicon for facing panels for buildings, which could be used to harness solar energy. The project aims to create highly efficient silicon films with nano-micro porous architectures, which will improve the efficiency of solar energy harvesting due to light trapping by internal reflection. The proposed concepts and methods are relevant to a wide range of applications where specifically high silicon surface to volume rates are of importance: solar cells, solar-driven generation of hydrogen, electrodes for lithium-ion batteries, precursors for production of silicon nano-particles and platforms for chemical and biological sensors.

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**NBR: 300569** **ACRONYM: QUANPHOCHIP** **EC FUND: 261853**

**DG:** REA **Call: FP7-PEOPLE-2011-IOF** **Thema:** FP7-PEOPLE-2011-IOF

**Title:** Quantum photonic chip

**Abstract:** Quantum technologies based on photons provide a promising path for building and using complex quantum photonic systems for both exploring fundamental physics and delivering quantum-enhanced technologies. While there have been impressive proof-of-principle demonstrations based upon on bulk optical elements, future technologies will require integrated optics architecture for improved performance, miniaturization and scalability. This project proposes to build a new class of quantum optics systems on a silicon chip. This integrated platform consists of integrated entangled-photon sources, high efficiency on-chip single-photon detectors and align-free quantum circuits to perform complex computing functions. This project will allow us to explore the forefront nanoscale quantum physics meanwhile simultaneously bring it to a practical engineering framework.

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**NBR: 300802** **ACRONYM: STRENGTHNANO** **EC FUND: 183805**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Strain engineering of atomically-thin nanomembrane-based electromechanical devices

**Abstract:** In the proposed project, I will engineer the electronic and mechanical properties of freely suspended 2D crystals such as graphene by strain engineering. Although strain engineering has been aready proposed as a powerful way of fine-tuning the electrical and mechanical properties of 2D crystals to create artificial 2D materials with novel functionalities, experimental studies of the role of strain in the electromechanical properties of 2D crystals are still very scarce. In the first part of the project, I will study the changes in the electronic and mechanical properties of freely suspended ultra-clean graphene flakes while their strain is externally tuned. We will measure changes in the piezoresponse, resonance frequency and quality factor of graphene devices for a broad regime of strains, ranging from compressive to tensile stresses. Special attention will be paid to the case where extreme tensions, close to breaking point, are applied to the graphene crystals. The general character of the experimental setups and techniques that will be developed will also make possible to work with other 2D crystals with properties very different than graphene. Indeed, during the second part of the project, I will modify the electronic properties topological insulators based on Bi2Se3 or Bi2Te3, by means of strain-engineering. Applying such strains will allow us to control the bulk energy band-gap and thus optimize/fine-tune the conduction through the topological surface states. The project is therefore at the forefront of science on graphene-based NEMS and on other interesting 2D nanocrystals, the bismuth-based topological insulators, and will strengthen the visibility of European research in these areas.

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**NBR: 300814** **ACRONYM: NEUROTRAF** **EC FUND: 183805**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Molecular mechanisms of synapto-dendritic cargo trafficking

**Abstract:** Activity-dependent modulation of synapses is the core mechanism of synaptic plasticity and underlies learning and memory processes in the brain. Understanding dynamic changes at synapses requires a deeper insight in the molecular machinery involved in the transport and trafficking of postsynaptic proteins. Recent studies suggest that the cytoskeleton (microtubule and actin) and molecular motors (kinesin, dynein and myosin) play an essential role in the targeting and delivery of cargos to synapses. Moreover, it has been shown that defects in synaptic cargo transport are common feature of many human neurodegenerative and psychiatric diseases. One of the limiting factors to study synaptic cargo trafficking in living neurons is the lack of appropriate molecular and imaging tools. Recent developments in super-resolution microscopy as well as the progress made in nanotechnology yield many new possibilities to study synaptic trafficking processes in neurons. In this proposal, we will address key issues in synapto-

dendritic protein transport by developing novel molecular tools and imaging systems in living neurons. These tools will be utilized to answer a number of fundamental questions: 1) What is the contribution of specific motor proteins to dendritic transport? 2) Do microtubule motors enter dendritic spines and transport cargos in and out? 3) What is the mechanism of cargo movement between neighboring spines? The expected outcomes of this project will contribute fundamental insights into trafficking processes in neurons and deepen our understanding of the molecular dynamics of synapses.

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**NBR: 300883** **ACRONYM: DIAMEMS** **EC FUND: 270145**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Microelectromechanical Systems from Nanocrystalline Diamond

**Abstract:** This project aims to develop high frequency, high quality factor micro and nano – electromechanical systems (MEMS) from nanocrystalline diamond (NCD). NCD offers superior performance to silicon for MEMS due to its extreme Young's modulus, but it is also compatible with silicon CMOS technologies, offering a key advantage over other potential MEMS materials. High performance NCD growth and planarization will be optimised for MEMS applications. The realisation of continuous, smooth (

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**NBR: 300928** **ACRONYM: TRANSFORMERSURFACES** **EC FUND: 184709**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Dynamic Libraries for the Synthesis of New Multifunctional Silica Striped Nanoparticles

**Abstract:** The last decades have been characterized by a great interest on nanotechnology applied to biology and medicine. Nanoparticles play a leading role thanks to their novel properties relative to their bulk material counterparts. Within TransformerSurfaces the training-through-research is targeted at synthesizing silica nanoparticles, coated with a molecular monolayer that can in turn be reversibly functionalized with different ligands following the principles of the Dynamic Combinatorial Chemistry (DCC). The goal is to obtain a new surface suitable for a larger range of possible functionalization. In particular, taking inspiration from the striped gold nanoparticles that have been recently discovered in the group, this project is targeted to functionalize the outermost coating of the silica nanoparticles with higher order patterns, especially stripes. In fact, these 'striped' nanoparticles are capable of penetrating cell membranes without porating (creating transient holes associated with leakage and cytotoxicity) as viruses do. Additionally by combining the biocompatibility of silica with the low toxic effect given by

the optimization of the ligands arrangement on the surface, we aim to erase the toxicity of nanoparticles.

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**NBR: 300966** **ACRONYM: MARCONI** **EC FUND: 184709**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Nano-scale and Artificial Materials for Adaptive Electromagnetic Wave Control

**Abstract:** This project will study the control of electromagnetic (EM) waves using exceptional materials, and the application of such to the design of novel adaptive guiding and radiating structures. Two classes of unusual 'materials' with similarities in terms of modelling method and potentials applications are concerned here, constituting two inter-related research lines (i) the nano-scale graphene material and (ii) artificial materials based on periodic structures. Concerning graphene, a first goal will be to derive simple yet efficient EM models for the monolayer atomic structure, derived from usual EM concepts and solid-state properties of graphene. Such modelling will be experimentally validated and then employed to the design of graphene-based devices, including wired and wireless intrachip interconnects and antennas. A very important aspect in this task is the tremendous potential of graphene for fully-integrated and effective device dynamic control, based on field-effect. In the case of artificial material made of periodic structures, they will be combined with MicroElectroMechanical Systems (MEMS) in order to achieve integrated EM devices with dynamic control capabilities. At the theoretical level, the properties of the periodic structures will be tailored to achieve unprecedented radiation capabilities (e.g. the total control of the radiated beam at all space directions). The frequency range of interest for these studies mainly concern millimeter-waves, but THz will also be considered in particular cases. Very importantly, both theoretical and experimental aspects will be carefully addressed. This ambition requires exceptional expertise and fabrication capabilities, which is available within the applicant team and host infrastructure and multidisciplinary activities. This research will significantly contribute to the crucial fields of nano-electromagnetics devices, dynamic configuration, and fully-tailored electromagnetic radiation for advanced applications.

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**NBR: 300983** **ACRONYM: NECPEM** **EC FUND: 209033**

**DG:** REA **Call: FP7-PEOPLE-2011-IIF** **Thema:** FP7-PEOPLE-2011-IIF

**Title:** NOVEL PRECIOUS AND NON-PRECIOUS ELECTROCATALYSTS FOR PEMFC

**Abstract:** Practical realization of PEMFCs is mainly hindered by the use of expensive Pt electrocatalysts (EC) coupled with their poor durability due to dissolution and agglomeration. While Europe paid significant efforts in improving the engineering aspects of PEMFCs, including hydrogen refuelling stations, development of alternative catalysts for Pt require further investments. Global attempts are focused on developing catalyst systems with less Pt or no Pt at all. In this regard, macromolecules with N4-chelate structure are considered as alternatives for Pt ECs especially for the ORR. Recently, non-precious carbon alloy catalysts (CAC) received considerable attention as the addition of nitrogen and metal atoms into the CNT matrix tend to improve their catalytic activity towards ORR. The induced activity of CNTs after such doping is mainly attributed to changes in electronic structure with an impurity band near the Fermi level. However, CAC performances are still inferior to that of Pt. One major drawback with reported CACs is that they do not control the size of metal dopants as the sintering tends to agglomerate them and leaves them in the CNT matrix as mere surface bound particles. Hence it is imperative to control the metal doping in the atomic scale as they can donate more electrons to the CNT matrix than nitrogen and could induce more catalytic activity. Thus in this proposal, we plan to prepare CACs with metal dopants controlled in the atomic scale to alter the electronic structure with improved durability as these metal atoms are now part of the CNT matrix. We plan to incorporate various metals into nitrogen based macromolecules such as aza-crown ethers and porphyrins which will be heat treated under reducing atmosphere to obtain CNT and Bucky ball like nanostructures with metal atoms at their centre. Such a study is of profound importance to EU considering the global efforts in finding alternative catalysts and could be the breakthrough it is currently looking for.

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**NBR: 300998** **ACRONYM: PERCIGS** **EC FUND: 181418**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** PercIGS

**Abstract:** To a large extent, the latest CIGS improvement is due to enhancements in the semiconductor material quality. However, as the material quality of the semiconductors improves, other parts of the solar cell are becoming the new bottlenecks to increase the efficiency further towards the theoretical limit for non-concentrated light, which is 30 %. Therefore, this project is focused on an advanced, yet industrially feasible, device structure: The introduction of point contacts and a passivation layer will be used to reduce the back contact recombination and thus enhance efficiency. The application focuses towards CIGS based solar cells, but the concept can be generalized to other high quality thin film solar cell technologies as well. The project is structured in four sub-projects, of which the motivations are described below. Specific goals: • An innovative concept to reduce the high recombination back contact surface area will be developed. This will drastically reduce the recombination rate at the back contact for state of the art

CIGS solar cells • Increase of solar cell efficiency by up to 1.5 absolute percent by increasing photo-generated voltage and current. • The concept will also be used as a powerful tool to investigate the influence of grain boundaries in the polycrystalline CIGS semiconductor material. The project has four main objectives: (1) point contact development, (2) assessment of passivation layers, (3) application in solar cell devices, and (4) a CIGS material study. A successful outcome will advance the current state-of-the-art in CIGS research, through: • New methods to develop nano-sized contacting points • Novel (rear) passivation layers for CIGS material • An advanced device structure to increase CIGS solar cell efficiency • Improved understanding of the influence of grain boundaries on charge transport in CIGS material

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**NBR: 301076** **ACRONYM: HSPILL-CEMA** **EC FUND: 111241**

**DG:** REA **Call: FP7-PEOPLE-2011-IIF** **Thema:** FP7-PEOPLE-2011-IIF

**Title:** Optimization of Hydrogen Storage via Spillover through a Combined Experimental and Modeling Approach

**Abstract:** The objective of the proposed work is to synthesize catalyzed nanoporous materials that have superior hydrogen uptake between 300K and 400K and moderate pressures (20-100 bar) via the hydrogen spillover mechanism. Hydrogen spillover involves addition of a catalyst to a high-surface area microporous support, such that the catalyst acts as a source for atomic hydrogen, the atomic hydrogen diffuses from the catalyst to the support, and ideally, the support provides a high number of tailored surface binding sites to maximize the number of atomic hydrogens interacting with the surface. The proposed work will provide a means to explore an extended collaboration to combine in situ spectroscopic techniques and theoretical multi-scale modeling calculations. Carbon-based and microporous metal-organic framework (MMOF) materials will be drawn from past and on-going projects, so that the project will focus on identifying specific binding sites for atomic hydrogen and resolving the hydrogen spillover mechanism. Materials will be selected to explore the effect of catalyst size, material composition and structure, interface, and the potential role of co-catalysts on optimizing uptake via the hydrogen spillover mechanism. Materials will be characterized with in situ spectroscopy, and multi-scale modeling will be used to identify hydrogenation sites. Validated theory will be used to direct future material development. Identification of the key sites responsible for high uptake in select materials is expected to lead significant increase in capacity and reproducibility in hydrogen spillover materials that are optimized for near-ambient temperature adsorption.

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**NBR: 301100** **ACRONYM: LOTOCON** **EC FUND: 185763**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Low-toxicity copper chalcogenide semiconductor nanocrystals

**Abstract:** The objective of the present project is a development of approaches for facile colloidal synthesis of Cu-containing semiconductor nanocrystals, characterized by low production cost, high stability, high photoluminescence efficiency and low toxicity. The materials that will be synthesized will undergo comprehensive physico-chemical characterization including a deep assessment of their toxicity and will be evaluated as light absorbing components for fabrication of excitonic solar cells. Copper chalcogenides represented by binary, ternary and quaternary compounds, like CuS(Se,Te), CuIn(Ga)S(Se,Te), CuZnSnS(Se,Te) are one of the most attractive series of low-toxic semiconductor materials, which are truly alternative to the widely studied cadmium, mercury and lead chalcogenides. This new generation of semiconductor nanocrystals is now being in the focus of a great scientific interest. These nanocrystals are characterized by tunable visible and near infrared emission and absorption properties and high extinction coefficients and therefore hold great promise in bio applications, in light emitting diodes fabrication, photovoltaics and optoelectronics. This project will provide new knowledge into the mechanisms governing the reactions involving the various precursors during the stages of nanoparticle nucleation. This new knowledge will then allow for a proper control of nanoparticles crystal structure, composition, size, shape, and consequently of their optoelectronic and photovoltaic properties. The synthesized and fully characterized copper chalcogenide nanoparticles will be used for fabrication of solar cells. Combination and adaptation of state-of-the-art approaches as well as creation of novel synthetic methods will result in innovative investigation covering wide range of tasks from the synthesis of novel materials through their comprehensive characterization and ending with their application in photovoltaics.

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**NBR: 301103** **ACRONYM: LISF** **EC FUND: 170046**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Mechanics of Energy Storage Materials: Swelling and Fracturing in Lithium ion Batteries electrodes during Charging/Discharging Cycles.

**Abstract:** One of the greatest challenges facing the electric power industry is how to deliver the energy in a useable form as a higher-value product, especially in the area of renewable energy. By storing the power produced from immense renewable sources off-peak (e.g., daytime for solar energy) and releasing it during on-peak periods, energy storage can transform low-value, unscheduled power into high-value “green” products. The development of high-energy and high-power storage devices has been one of the research areas of top-most importance in recent years. Lithium batteries currently have the highest energy storage density of any rechargeable battery technology. Their

behavior is based on the classical intercalation reaction during which lithium is inserted into or extracted from both cathode and anode. Huge volume changes are associated with this process, often resulting in disintegration of the material. Exploration of nanostructure is one of the encouraging research directions in order to avoid materials failure. Experiments suggest that size reduction is an effective strategy in creating fracture resistant electrodes. Using a combination of diffusion kinetics available in the literature and fracture mechanics, the first part of project aims at giving insights on the critical size for flaw tolerant nano-structured battery electrodes. Approximated analysis of crack coalescence and debonding at the interface between active particles and porous electrodes will be achieved by means of new ad-hoc multi-physics cohesive interfaces. Since effects at different scales are involved during charge/discharge cycles, the simulation of the mechanical response of Li-Battery systems requires a multi-scale approach. The second part of the project aims at enriching current computational homogenization techniques - originally developed in the framework of elasticity for heterogeneous materials - as a tool to model the electrochemical-mechanical interactions in lithium batteries.

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**NBR: 301110** **ACRONYM: MOLSURMOF** **EC FUND: 174475**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** MOlecular Loading and SURface anchoring of Metal-Organic Frameworks: a training and career development action

**Abstract:** The goal of the MOLSURMOF project presented in the frame of the Marie Curie IEF Action is the loading of metal-organic crystalline and porous frameworks anchored to solid surfaces (SURMOFs) with organic electroactive molecules in order to measure their electrical properties. The use of SURMOFs as high density containers for electroactive molecular nano-objects shall produce surface coatings for which the measurement of the electrical properties does not represent a formidable problem, differently from what happens using MOFs obtained by the solvothermal synthesis process. To load the SURMOFs two main strategies will be followed: 1) evacuation of the SURMOF by heating it up in air at a known and controlled temperature and then exposure to the vapors of the guest molecule; 2) loading of the SURMOF under flow conditions, i.e. during its surface growth. The general objective of the proposed project is to measure transport of the electrons through the loaded SURMOF or the conductivity arising from the transport of mobile species by means of a three electrodes set up or, when possible, of scanning probe microscopy technique combined with electrochemistry. The results of this research shall pave the way towards the use of these coatings in electrical or electronic applications. Furthermore, by the accomplishment of the scientific objectives through a multidisciplinary approach, a young female researcher will be given the opportunity to receive an excellent and complete training-through-research inside Europe and to reach the professional maturity needed for her future career as independent researcher.

**NBR: 301182** **ACRONYM: CHOIS** **EC FUND: 200371**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Characterisation of hybrid inorganic-organic solar cells by advanced spectroscopic methods

**Abstract:** The displacement of CO2 emissions by renewable sources of energy critically depends upon the development of low-cost and widely accessible routes to clean energy generation. Of all the renewable energy sources, solar energy has the greatest potential as a world power source. However, the inorganic solar cells available on the market now are too expensive to compete with conventional power sources. Hybrid solar cells are an emerging solar cell technology with a great potential for cheap fabrication. They usually consist of a nanostructured junction of inorganic and organic semiconductors and therefore combine cheap and abundant organic materials with the advantages of inorganic materials in terms of stability and charge transport. Power conversion efficiencies exceeding 3 % have been obtained and there is a large potential for further efficiency improvements. In order to achieve these, a detailed understanding of the working mechanism of hybrid solar cells is of crucial importance. In this project, we therefore aim to carry out an in-depth characterization of hybrid solar cells using a variety of advanced spectroscopic and microscopic techniques and a multidisciplinary approach. The project will consist of three phases: In the first phase, a state-of-the-art hybrid CdS/polymer system will be characterised in order to gain a better understanding of the working mechanism of the solar cells. Following this, hybrid solar cells consisting of different materials and prepared by different methods will be compared and loss processes in the solar cells will be identified. In the final phase of the project, the gained knowledge will be used to propose new materials combinations, which will lead to the construction of more efficient hybrid solar cells. The proposed project will therefore aim to develop a scientific framework that will enable the custom design of hybrid inorganic – organic heterojunctions for high performance solar cells.

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**NBR: 301204** **ACRONYM: APOPTOPROBES** **EC FUND: 200371**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Development of novel MRI and PET probes for the detection of apoptosis

**Abstract:** Magnetic resonance imaging (MRI) has become an indispensable medical diagnostic tool because of its ability to produce detailed 3D pictures of tissue in the body noninvasively. Gadolinium is used in MRI contrast agents because of its strong paramagnetic

properties. However, due to its intrinsic toxicity when free in solution, it has to be bound to other biocompatible molecules to be used clinically. There are currently seven approved gadolinium contrast agents that are used for MRI studies in humans. However, these contrast agents have some drawbacks: e.g. they are not targeted to specific tissues and their sensitivity is still below what can be theoretically achieved. Therefore, there is great current interest in improving the properties of Gd-based contrast agents by attaching the metal to a variety of materials, ranging from large organic molecules to nanoparticles. Phosphatidylserine (PS) is the most abundant anionic phospholipid of the plasma membrane and, in healthy cells, is arranged largely on the inner layer. In some abnormal cells this is not the case and a considerable amount of PS is displayed on the outer membrane surface; this is known in cells undergoing apoptosis (programmed cell death) and tumour vasculature. Therefore, detection and imaging of apoptotic cells in vivo is desirable, as a clinical and research tool. Recently the host group showed that a Gd metal complex is able to bind polyphosphates and, interestingly, the probe localises selectively on apoptotic cells allowing for enhanced MRI signal in apoptotic vs. non-apoptotic cells. To follow on this previous work, we propose to develop more sensitive and selective Gd-based probes for MR imaging of apoptosis. Furthermore we propose to extend this idea towards positron emission topography (PET) by including Ga in the probes. The new probes developed, will be first fully characterised and validated in in vitro experiments to then be tested against apoptotic and non-apoptotic cell lines.

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**NBR: 301307** **ACRONYM: CELL WALL METABOLISM** **EC FUND: 200371**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Functional analysis of osmo-sensitive signalling processes regulating the metabolic response to environmental stress

**Abstract:** Plants use light energy, carbon dioxide, and water to produce monosaccharides - the building blocks of the polysaccharides forming plant cell walls. Plant cell walls represent the first line of defence against environmental stress while representing the bulk of the biomass used for bioenergy production. Their composition and structure influences both efficiency of bioenergy production and resistance of food crops to biotic / abiotic stress. The plant cell wall integrity maintenance mechanism monitors the functional integrity of the wall and initiates changes in cell wall structure / composition and metabolic changes in response to cell wall damage (CWD) to maintain functional integrity of the cell wall. The aim of the proposed research is to dissect the mode of action of the mechanism coordinating cell wall integrity maintenance with primary metabolism in Arabidopsis thaliana. Previous work in the host lab has implicated sugar-based signalling and turgor-sensitive processes in the response to CWD. The host lab has developed FRET-based nanosensors targeted to different cellular compartments for in vivo soluble sugar detection. These sensors will enable determination of the effects of CWD and turgor manipulation on intracellular soluble sugar distribution with subcellular resolution. In

addition, a phospho-proteomics approach will be employed to identify and functionally characterise novel proteins required for mediating the response to CWD and turgor induced metabolic changes. Candidate proteins identified in the screen will be validated by biochemical assays and phenotypic characterisation of candidate gene knockouts. The results of this project will provide novel insights into the cell wall integrity maintenance mechanism that could lead to improved food crop performance and facilitated bioenergy production.

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**NBR: 301363** **ACRONYM: SITELITE** **EC FUND: 193726**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Deterministic coupling between SITE-controlled, dilute nitride-based LighT Emitters and tailor-made photonic-crystal structures

**Abstract:** The establishment of a simple, reliable method for the deterministic coupling of nm-sized light emitters with photonic crystal (PhC) cavities is expected to propel the field of nanophotonics into a new era. Indeed, the possibility to place single quantum objects at arbitrary points of a PhC structure would allow for the realization of complex photonic circuits, integrating single- and entangled-photon sources as well as PhC routers, switches, and delay lines. The SITELiTE project will position itself at the forefront of this forthcoming revolution, through the exploitation of a novel method for the fabrication of site-controlled nano-emitters (quantum dots, but also individual impurity complexes) by spatially-selective hydrogenation of dilute-nitride materials, recently demonstrated by the Host Institution [the G29 laboratory of Sapienza University of Rome; see, e.g., Adv. Mater. 23, 2706 (2011)]. The PhC cavities employed by the present project will be designed with an innovative semi-analytic method, recently introduced by the fellow, Dr. M. Felici [Phys. Rev. B 82, 115118 (2010)]. Through the definition of a direct relationship between the target electromagnetic field distribution and the dielectric constant of the cavity supporting it, this method eliminates the need for the cumbersome, computationally demanding trial-and-error procedures that currently hinder further developments in the field of PhC cavity design. Initially, this approach will be applied to cavities supporting modes with Gaussian envelope function and ultra-low cavity losses. Then, the project will focus on the engineering of PhC structures with more complex mode distributions, including systems of coupled cavities and PhC cavities with disorder-insensitive properties. The designed PhC structures, integrated with the light emitters fabricated by spatially-selective hydrogenation, will be realized by electron-beam lithography, and characterized with advanced optical spectroscopy techniques.

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**NBR: 301369** **ACRONYM: CHESS** **EC FUND: 193594**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Block Copolymers for High Efficient Solar Cells with novel Structures

**Abstract:** This IEF project aims to address both hurdles apparent in the fabrication of Bulk Heterojunction Organic Photovoltaics (OPVs), i.e. the tailoring of the domain size to be close to the excitonic diffusion length and the stability of the blend morphology, through a wise incorporation of block copolymers in the blend that forms the active layer of OPVs. My target is to fabricate highly efficient solar cells with enhanced morphological stability and prolonged lifetimes, applying process techniques that can be easily adopted by industry. The self-assembly properties of block copolymers as well as their ability to form well controlled nanostructures and to act as compatibilizers in the blends of the respective homopolymers will be exploited to form stable nanomorphologies with optimum domain size, according to the specifications required for OPV applications. An integrated study will be conducted, starting from fundamental research on the polymer physics of the ternary system: rod-like homopolymer A – homopolymer B – rod-coil copolymer A-B. Next, the blends which exhibit the desirable co-continuous morphological characteristics will be incorporated into OPVs and the device performance and stability will be studied and optimized. Finally, I am going to apply the concepts of graphoepitaxy, a novel technique applied for the fabrication of well-ordered arrays of block copolymers, in the construction of OPVs, in an effort to realize the ideal interpenetrating structure proposed and achieve even higher efficiencies through a precise control of the nanostructure. The scope of the proposed research lies on the cutting-edge field of organic electronics (OE), which is of strategic importance for the competitiveness and the advancement of the socio-economic conditions of the European Union. The skills acquired during my studies will be complemented by the extensive experience of the host institute on OE to assure a successful accomplishment of this fully interdisciplinary project.

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**NBR: 301398** **ACRONYM: POLYTRIGG** **EC FUND: 192622**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Bioactive block copolymer vesicles as pH-triggerable, nano particulate carriers for cancer vaccination

**Abstract:** Advanced designed vaccines have to combine proper antigen with the effective immune-stimulating agents (adjuvants) and delivery strategies in order to attain successful treatment. Presently, most vaccines are given as liquid formulations by intramuscular administration. However, nano-sized carriers of antigens hold great promise to be more effective delivery systems. To achieve the desired anti-cancer therapy; the ideal antigen nano-carrier has to fulfil a number of requirements. First of all carriers need to be (hollow) particles like with diameters in the range 50-500 nm in

order to be taken up by dendritic cells (antigen-presenting cells capable to induce immune response). To facilitate the development of cellular immune responses, vaccine antigen must be presented on MHC (Major Histocompatibility Complex) class I. To win the goal, the nano-carrier should selectively bind to these cells, and be taken up into endosomes. To doing this carriers should be able to display certain adjuvants as targeting and stimulating ligands on their surface, and be capable to release its cargo upon response to pH changes in the endosome. Furthermore, vesicles have to carry and release antigen (i.e. proteins) to target destination with minor side-effects (biocompatibility and non-toxicity of carrier are essential). Hence, it is the goal of proposed project to develop nano-carriers on the basis of block copolymer vesicles (polymersomes) that have all those features. The aim is to developed polymersomes based on amphiphilic poly(2-methyloxazoline) PMOXA or (polydimethysiloxane) PDMS blocks in combination with stimulus-responsive copolymers blocks and a tunable polymersome surface chemistry. Therefore, the final goal is to provide "smart" drug delivery system with versatile surface chemistry, which will allow the attachment/incorporation of different adjuvants (e.g. saponins) and consequently enable target delivery.

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**NBR: 301463** **ACRONYM: HYDRA** **EC FUND: 191938**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** The role of hydrogen bonding and water dynamics in the self-assembly of proteins and lipids: a comprehensive experimental and computational investigation

**Abstract:** The plan proposed for the two-year Marie-Curie fellowship aims at providing the applicant with the hands on experience and theoretical knowledge required to undertake an independent simulation activity in soft condensed matter physics. This is intended to complement the experimental activity on the same subject already carried out by the applicant Dr. Antonio Benedetto. Experimental and computational work will continue in parallel after the completion of the fellowship, providing a privileged basis for acquiring a leadership role in bio-physics soft-matter research. Training in computational methods will take place at Queen's University of Belfast, supervised by Prof. Pietro Ballone. The acquisition of modelling and simulation experience will be driven by the development of three different but related sub-projects, concerning: (i) the role of water in the equilibrium polymerisation of actin and tubulin; (ii) the interaction of room-temperature ionic liquids with lipid bilayers; (iii) the role of hydrogen bonding and hydrophobicity in the stabilisation of amyloid fibrils, with insulin as a prototype system. In all these problems, hydrogen bonding, hydrophobicity/hidrophilicity, and the dynamics of water molecules play the central role. Neutron scattering and simulation both represent powerful tools to investigate these properties, and their combination will provide a direct and microscopic view of the systems under investigation. Besides providing a comprehensive training in atomistic

simulation to Dr. A. Benedetto, the three subprojects are expected to provide a wealth of important new results, with important implications for pharmacology, toxicology, environmental sciences, nanotechnology and medicine. The training and scientific work will be complemented by a series of outreach activities that are discussed in the application.

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**NBR: 301472** **ACRONYM: NANOPETALS** **EC FUND: 200371**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Molecular mechanisms of petal iridescence: how do structural colours arise in flowers?

**Abstract:** Iridescent animals, such as peacocks and butterflies, owe their stunning colours to the manipulation of light by minute structures organized on or just below their surfaces. Iridescence is common in animals where it acts as mimicry or as a signal for mate selection, but it has been poorly studied in plants. The Glover lab recently discovered that flowers also produce structural colours, visible to pollinators, due to ordered striations (like those on a CD) of the cuticle on the petal epidermis. How and when these features develop is unknown. To unveil the genetic mechanisms behind iridescence, I will carry out high-throughput molecular studies along with microscopic observations and biochemical analysis using Venice Mallow (Hibiscus trionum) as a model species to establish the identities and the functions of genes governing the assembly of epidermal ridges. To conduct this work, I will also benefit from ongoing collaboration with physicists to establish the optical properties of these nanostructures, from behavioural ecology tools present in the lab to test pollinators' reactions to iridescent petals and from the new methodologies I developed during my PhD. This project will discover original developmental pathways, used by flowering plants to shape their surfaces and communicate with insects.

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**NBR: 301474** **ACRONYM: NANOSMART** **EC FUND: 191675**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Smart nanosystems for advanced cancer therapy

**Abstract:** Advances in the preparation of nanotechnology-based materials in medical science pose new challenges in the design of smart nanodevices capable of meeting clinical needs. These systems are called to solve the issues associated to a non-specific delivery of drugs, which lead to the failure of a large number of treatments for oncological diseases. A selective and safe carrier for drug delivery should be actively targeted to malignant cells and display a stimulus-responsive behavior controlled by external means. The

present project is aimed at developing targeted delivery vehicles able to release the required dose of chemotherapeutics in response to local temperature increases. For this purpose, an emerging technology based on magnetic resonance imaging (MRI) and high intensity focused ultrasounds (HIFU), MRI-guided HIFU, will be combined with selective nanomedicine to provide a full spatial and temporal control of the release process. This novel MRI-assisted triggered drug delivery allows improving the performance of chemotherapy and better monitoring the regression of disease. The research project is built around two main objectives: 1) the design and synthesis of novel biocompatible thermosensitive carriers based on inorganic-organic hybrid nanospheres with targeting nanobody moieties, and 2) the in vitro and in vivo evaluation of MRI-guided HIFU-triggered drug release. This proposal represents a unique opportunity in the context of nanotheragnostics for tailored chemotherapy, and means a significant step towards its clinical translation. The project is in the core of 2 of the 10 themes of the FP7 Cooperation Program, Health and Nanosciences, Nanotechnologies, Materials & New Production Technologies. This research in smart drug delivery nanodevices constitutes a highly multidisciplinary approach with large impact in near future advanced therapies and with a great chance for collaboration and networking between European groups and industrial partners.

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**NBR: 301635** **ACRONYM: BIOHYMAT** **EC FUND: 200371**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Biomimetic organic-inorganic hybrid structural materials

**Abstract:** The proposed project is aimed at developing a bottom up process for the creation of biomimetic organic-inorganic structures. The process will include from the molecular stage to prepare the phases involved, to the use of emerging techniques to fabricate bio-inspired structural materials with regenerative applications in the biomaterials field. The first part of the project will be the synthesis of different hydrogels for the organic phase. This hydrogels will be formulated in base of modified polymers. The selected polymers are chitosan (as a natural polymer) and poly(2-hydroxyethyl methacrylate) (PHEMA, as a synthetic polymer), that will be chemically and physically modified to improve a subsequent mineralization with the inorganic phase. The hydrogels will be used as templates for the crystallization of apatite nanoparticles. Before carrying out a bulk mineralization, a complete study of this stage will be performed in 2D (thin films) and 3D (blocks) with the aim of studying and characterizing the mineralization mechanisms and the organic-inorganic interface. The last part of the project will be the mineralization of the hydrogels and the creation of three dimensional scaffold materials inspired in hierarchical natural structures like bone. Different forming techniques, like freeze casting and electrospinning will be used, including a study of the different forming conditions both in the final structures and in properties. The project will be

completed with a microstructural, chemical and mechanical characterization of the final materials.

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**NBR: 301656** **ACRONYM: ATOMICFMR** **EC FUND: 193594**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** FERROMAGNETIC RESONANCE AT THE ATOMIC SCALE

**Abstract:** Magnetoresistance, giant or tunnel, is at the heart of several 'spintronic' components, a new branch of electronics based on the spin of the electron with applications in information technology. Because of the never ending drive for miniaturization, spintronics is about to reach the ballistic regime of electronic transport for which spin dependent properties are still not completely understood. Further size reductions can even be achieved in constrictions of atomic sizes obtained by slowly stretching a nanostructure in a sensitively controlled manner. In these systems, static magnetotransport measurements result from the low-dimensional magnetism of a few relevant atoms. In parallel ferro-magnetic resonance (the magnetization precession induced by a radio-frequency magnetic field) has seen a renewed interest lately as it has been shown that magnetization dynamics interacts with spin currents. Its correlation with DC transport is being widely studied and it is now possible to electrically measure ferromagnetic resonance using the inverse spin Hall effect or the Anisotropic Magneto-Resistance (AMR). The latter can be scaled down to atomic sizes thus giving the possibility to open the unknown field of the dynamical magnetic properties of a single atom in a low dimensional local geometry. We have very recently demonstrated that FMR can be detected in narrow constrictions using the AMR mixed with the RF current auto induced in the magnetic circuit, leading to a measurable DC voltage. After a strong experimental effort, an original setup has been built which allows us to electrically detect the ferromagnetic resonance at 77K in samples that can be broken in real time during the measurements. This unique tool will allow us to study the resonance properties of a single atom in a low-dimensional configuration. It may even allow us to demonstrate that some metals like platinum could become magnetic in these atomic contacts.

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**NBR: 301723** **ACRONYM: AQUACAT** **EC FUND: 224462**

**DG:** REA **Call: FP7-PEOPLE-2011-IIF** **Thema:** FP7-PEOPLE-2011-IIF

**Title:** Tailor made lipases for synthetic catalysis in biphasic media: From poly (lactone) applications towards novel sugar esters

**Abstract:** AquaCat aims to design greener chemical processes by combining the use of lipase catalysis to that of aqueous biphasic reaction media with a specific view to the synthesis of poly(lactone) nanoparticles and sugar esters for pharmaceutical, cosmetical and chemical applications. A multidisciplinary approach encompassing physical chemistry and polymer science as well as industrial biotechnology, biocatalysis and enzyme technology will be followed to cover the various relevant scales. AquaCat will tailor the lipases microenvironment, design the reaction medium making lipase function as synthetic catalyst of confined organic substrates and identify the relevant parameters for industrial scale up of these processes. AquaCat will thus circumvent major problems in the current manufacturing processes making the use of organometallic catalysts, hazardous organic solvents, high energy consumption and multi-steps for nanoparticle elaboration obsolete. Lipases will be used to catalyze the ring-opening polymerization in nano-emulsions consisting of lactone nanodroplets dispersed in aqueous or aqueous-biphasic systems. The most innovative aspect of AquaCat is to directly synthesize the core-shell poly(lactone) in one step in water. The same principle will be applied to the synthesis of important specialty chemicals like sugar esters based on renewable feedstock. A trademark of this project will thus be the possibility to transfer and merge the expert's fundamental background in colloid/polymer science, industrial biotechnology and biocatalysis from the third country into the EU giving novel insights into the basic reaction mechanisms and the influence of the emulsion properties on enzyme catalysis. Thus, AquaCat will create mutually-beneficial research co-operations and enable the application of results to other valuable substrates and could soon become a feasible strategy for the European industry to design sustainable processes for high value-added products.

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**NBR: 301793** **ACRONYM: CNTBUS** **EC FUND: 278807**

**DG:** REA **Call: FP7-PEOPLE-2011-IIF** **Thema:** FP7-PEOPLE-2011-IIF

**Title:** In-situ fabrication of carbon nanotubes and bulk structures of designed configuration

**Abstract:** Bulk structures of carbon nanotubes (CNTs) of designed configurations and patterned microstructures, such as ropes, mats, tubes and cross-tubes, are expected to be widely used as super-reinforcements, filters, masks, catalyzer carriers and coatings etc. However, although huge researches have been carried out in this field, the preparation of CNT bulk structured materials is a very challenging problem and still in dark. The main objective of this proposal is to instigate a knowledge transfer project between Dr Jianlin Li, from the world renowned Hainan University and Dr Haitao Ye from the Nanoscience Research Group at Aston University (UK) to explore a novel, economical and straightforward approach towards mass production of CNT bulk structures with various complicated configurations and patterned microstructures. This novel idea stems from current work comprising the following two directions: (1) direct formation of bulk precursor fiber structures of desired configurations on ice collectors during

electrospinning; and (2) during annealing, in situ transformations of the spun fibrous structures to metal-containing carbonaceous fibrous structures, and subsequently to bulk structures of CNTs with desired configurations. The proposal aims to bring expertise to the ERA to develop and understand a new approach of directly fabricating CNT Bulk Structures (CNTBUS) of designed configurations by the tunneling of metal nanoparticles in the carbonaceous fibers, to replace currently used approaches. The demand for these new materials will be huge, bringing a leading expert to transfer his expertise to the ERA will enable Europe to take its place at the forefront of development in this field. The proposal will contain several innovative methods to ensure that the findings are quickly disseminated to important European Academic groups, private sector organizations, and industries.

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**NBR: 301898** **ACRONYM: EPOFO** **EC FUND: 200371**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Electron probing of functional oxides

**Abstract:** This project is aimed towards unlocking the properties of functional oxides such as ferroelectric (BaTiO3, BiFeO3 on SrNbxTi1-xO3/SrTiO3) and multiferroic (CoFe2O4 on BaTiO3) thin films. The need for manufacturing such thin films with tailored properties is currently growing immensely due to their potential for a wide range of applications including high frequency electronics, microwave tunable devices, and memory based devices. The key feature of these devices is the speed of tuning and the most inhibiting factor in their usability is the slow relaxation processes which are attributed to the residual polarization caused by the space charge formed due to the injection of electrons from electrodes and its trapping by defects and/or oxygen vacancies on the oxide film-electrode interface and/or inside the film itself. Currently, there is a critical demand for the development and application of characterization methods that are able to probe the physicochemical material parameters on the very local scale. To address this, an integrated multidisciplinary approach will be undertaken. State-of-art nanoanalytical electron microscopy techniques will be applied and developed to determine the films potential for the next-generation nanoscale components pertinent to microwave and memory devices. Specifically the objectives of the proposed research are (1) to investigate the structural defects/domain structure of ferroelectric/ multiferroic thin films, (2) to probe the oxygen deficiencies/vacancies at the interfaces, and (3) to experimentally identify and evaluate the space charge distributions arising from these defects. Finally, all experimental results will be weighed against theoretical predictions. Ultimately, the results of this project will elucidate the switch-ability, i.e. the inherent speed of tuning, of the materials at sub-nanometer scale, by rationalizing the role that each of the above-mentioned, critical attributes play in regulating the relaxation processes.

**NBR: 302009** **ACRONYM: HYPHONE** **EC FUND: 228082**

**DG:** REA **Call: FP7-PEOPLE-2011-IIF** **Thema:** FP7-PEOPLE-2011-IIF

**Title:** Hybrid Photonic Metamaterials at the Multiscale

**Abstract:** In recent modern optics, two rapidly developing branches can be identified: (i) photonics, which studies materials structured on a mesoscopic (micrometer or wavelength) scale, and (ii) optics of metamaterials, which are structured on a nanometer (deeply subwavelength) scales. In both these branches, revolutionary degree of control over light propagation and light-matter interaction has been achieved. However, they still remain relatively isolated fields of study. This project is aimed at developing a unified theoretical paradigm of hybrid multiscale photonics by combining the knowledge of photonics, plasmonics, and optics of metamaterials. It is expected that synergies between photonic band gap phenomena and exotic plasmonic excitations present in metamaterials will significantly enhance the possibilities for controlling the flow of light and tailoring light-matter interaction at the nanoscale. Central to the project are hybrid photonic/metamaterial systems where the elements (e.g., layers) are arranged in a periodic or aperiodic “superstructure” and themselves contain metamaterials “substructured” on a deeply subwavelength scale. The studies will start with simple geometries such as metal-dielectric multilayers with micrometer-scale superstructure and nanometer-scale substructures, moving on to more complicated 2D/3D systems based on nanowires and nanoparticle clusters. The resulting theoretical concept, applied to hybrid photonic/plasmonic/active systems (such as metal nanoparticle arrays embedded in polymer matrices doped with dye molecules), will be used to design novel plasmonic materials with low loss and/or optical gain. It will also lead to novel physical concepts such as random spasers or deterministically aperiodic photonic/plasmonic nanolasers, with applications in efficient on-chip frequency/polarization filtering, on-chip label-free sensing, and on-chip device-enhanced light-matter interactions.

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**NBR: 302088** **ACRONYM: PHOTOQWELL** **EC FUND: 200371**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Photonic optimisation of multiple quantum well structures for single and dual-junction solar cells"

**Abstract:** Concentrator photovoltaic solar systems achieve some of the highest module power conversion efficiencies and have the potential for clean electricity generation in the

world's deserts and arid regions. Sunlight is collected by inexpensive optical collectors and focused upon small but highly efficient solar cells. Still, the costs of the overall system is high and further improvements must be done to enable the general implantation of this technology. This project will raise the efficiency of those highly efficient multi-junction solar cells by using nanotechnology to tailor the optical and electronic properties of the photovoltaic material. Key to the project is the design of internal optical modes in the solar cell, exploiting quantum effects, maximising absorption, reducing radiative loss and enabling the cells to become more tolerant to the changes in the solar spectrum that occur naturally during the day and season of the year.These designs will then be demonstrated in single and monolithic dual-junction prototype solar cells with the potential to break the present world record for a dual-junction solar cell of 31.7% and aiming to a 35% efficient devices.

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**NBR: 302157** **ACRONYM: NANOULOP** **EC FUND: 174475**

**DG:** REA **Call: FP7-PEOPLE-2011-IIF** **Thema:** FP7-PEOPLE-2011-IIF

**Title:** Nano-Architectures for Ultrafast Optoelectronics

**Abstract:** We propose to fabricate nano-patterned electronic circuits to demonstrate the control of the electronic motion by ultrafast photonic tools. Nanowires and nanosheets will play an important role to build the nano-architecture which allows the direct measurement of the photo current induced by intense, near single-cycle light fields with stable well-defined waveforms. Much attention will be focused on gallium nitride nanowires and titanate nanosheets due to their unique optical and electrical properties and their potential for applications in nanoelectronics. The growth of gallium nitride will be carried out by molecular beam epitaxy. Titanate nanosheets which are wide band gap semiconductor single crystals will be synthesized by exfoliation of layered titanate oxides. Furthermore, assemblies of multilayer films in which the nanosheets are used as building blocks will be fabricated via the layer by layer method. The nanomaterials will be used as bridges between two gold electrodes to build the nano-architectures for attosecond measurements. A valence band electron in a wide band gap solid can find itself promoted by an intense optical field into the conduction band, either by direct photon absorption, multi photon absorption or adiabatic interband tunneling. A second synchronized near single-cycle near-infrared field with well defined waveform will induce an electron momentum asymmetry resulting in a measurable electric current which can be controlled by waveform of the laser pulse. Such operation would enable the detailed understanding of the charge transport processes in direct time-domain, such as dephasing and electron scattering, in low dimensional systems. This project would help not only to demonstrate light-field control of electron motion in low-dimensional systems but also to develop ultrafast electronic technologies like logic circuits performing at optical frequencies in low-dimensional materials.

**NBR: 302197** **ACRONYM: BI-NANO PT/HYDRO CNF** **EC FUND: 200371**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** â€œNew Bi-Functional Catalyst and Meso-porous Layer for PEM Fuel Cells: Low Loading of Pt Nanoparticles on One Side of a Hydrophobic CNF Layerâ€•

**Abstract:** Proton exchange membrane fuel cells (PEMFCs) in combination with hydrogen are considered one of the best candidates to help to mitigate the climate change. However, there are still some challenges to release this technology to the market. One of the main costly issues for its commercialization is the amount of the platinum (Pt) that is used as catalyst, especially in the cathode where the oxygen reduction reaction (ORR) takes place. Even though progress has been made during the past years decreasing the Pt loading, the utilization and stability of Pt must be increased to meet the application demands by changing the current commercial carbon support (mainly Vulcan XC-72). Here it is proposed the use of a hydrophobic carbon nanofiber (CNF) layer as Pt support that combine high stability to oxidation, high specific surface area without micropores and large pore volume. The first part of the project consists of the growth of a CNF layer, which is directly grown on one side of a carbon paper substrate. The first objective of the project is the direct deposition of Pt nanoparticles on only one side of the CNF layer while avoiding a deep penetration of the Pt particles and maintaining certain hydrophobicity. The external location of the Pt particles, close to the central membrane, is crucial for a high fuel cell performance. On the other hand, certain hydrophobicity is needed to improve the evacuation of water formed in the cathode eliminating, or at least reducing, the use of PTFE. The second objective is the study of the influence of the addition of proton conductive polymers in the electrocatalytic ORR of the electrode. Finally, the last objective is the fuel cell electrochemical characterization of the electrodes by preparing membrane electrode assemblies (MEAs) by using commercial and/or in-house prepared anodes and membranes, so that the fuel cell performance can be measured and compared with a commercial MEA based on Pt/Vulcan XC-72.

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**NBR: 302251** **ACRONYM: SOILARCHNAG** **EC FUND: 200371**

**DG:** REA **Call: FP7-PEOPLE-2011-IIF** **Thema:** FP7-PEOPLE-2011-IIF

**Title:** EFFECT OF SOIL ARCHITECTURE ON TRANSPORT AND RETENTION OF SILVER NANO-LITTER

**Abstract:** A lack of understanding of the human and environmental health implications of nano-materials has deterred public and scientific support for nanotechnology evolution across

industries. Nano-silver in particular has gained increasing popularity due to its biocidal properties in the garment industry to create odor-free clothing. An increase in “nano-litter” release to the environment is expected from erosion by product use and land application of nano-litter enriched wastewater sludge. This project will investigate the transport of nano-silver in soils through laboratory experiments using a novel 3-dimensional soil model technique that creates reproducible replicates of real soil pore networks, and simulations that combine non-equilibrium statistical physics of particle-solid interactions with information of Lattice-Boltzmann flow fields. The objectives are to: i) determine the effect that soil structure has on the transport of nanoparticles, ii) assess the capacity of soils under different land management practices (and therefore different soil architectures) to filter out suspended nano-litter from groundwater, and iii) develop a modeling tool to help industry forecast the propagation of nano-enabled products and their derivatives through soil environments from product use and disposal. The findings of this study are expected to directly impact environmental policy in the host country as well as worldwide.

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**NBR: 302315** **ACRONYM: NBC-REGEN4** **EC FUND: 200371**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Nanostructured & Biomimetic Ceramic-Polymer Composites for Bone Tissue Regeneration

**Abstract:** The interdisciplinary proposal NBC-ReGen4 is based on the existing expertise in materials science of the incoming European Fellow (Dr. Piergiorgio Gentile) in combination with the host laboratories knowledge of biocompatibility assessment and medical device development (University of Sheffield-Scientist in charge: Prof. P.V. Hatton). NBC-ReGen4 is a timely project with respect to the scientific and technological advance on the state-of-the-art and with clear translational relevance to industry and ultimately patients. It aims to produce, characterise and evaluate a series of nanostructured composites with significantly improved properties compared to the existing state-of-the-art, specifically including suitable membranes for guided bone regeneration. Conceptually, the adaptation of nanostructured composite membranes for the development of functional devices in different applications represents a major step forward in the increasingly competitive field of tissue engineering and regenerative medicine. It is also an ideal time to train a talented materials scientist in new methods related to biological evaluation of a biomaterial, as well as transferable skills that will significantly boost his career prospects and opportunities to contribute to society. In detail, in NBC-ReGen4 the innovative composite membranes will be based on commercially available or in-house fabricated calcium phosphate particles incorporated into a resorbable medical polymer matrix (polyglycolic acid or poly(lactide co-glycolide)) further processed by electrospinning. The obtained composite membrane will consist in bilayered structures that can be modified and characterised for specific applications

where bone tissue regeneration is required on only one side. Surface functionalization of the different layers to enhance specific properties (such as biomimetic and anti-inflammatory properties) by low-risk and environmentally-friendly techniques, will be also implemented.

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**NBR: 302505** **ACRONYM: ISOGIRE** **EC FUND: 201932**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Insights from heavy stable isotopes to the study of Ag (and Ag-nanoparticles), Cu and Zn contaminations and biogeochemical processes in the Gironde Watershed and Estuary

**Abstract:** The use of heavy stable isotopes for tracing the source of Metallic Trace Elements (MTE) in the environment has been well established during the last decade but focused mostly on simple cases (local point source pollutions), while Ag has remained unexploited in this respect. The ISOGIRE project aims at investigating heavy stable Cu, Zn and Ag isotope fractionation in the large scale (80000 km²) and well constrained Gironde continuum (as a model case system). The objective is to use MTE isotopes to identify and discriminate different (diffuse and point) source of pollutions and their evolution in time, accounting for biogeochemical processes (non-conservative behaviour by reactive estuarine mixing and biological uptake by oysters) that may modify their isotopic signatures. The ISOGIRE project relies on a multidisciplinary approach linking metallic trace elements isotope geochemistry, biology/ecotoxicology and mineralogical in situ analysis. The ISOGIRE project will address the recent issue of emerging Ag contamination observed in the Gironde estuary and surface waters worldwide, presumably due to the rise of Ag (and Ag nanoparticles (NP)) in consummer's goods. A versatile analytical methodology for Ag isotopes measurements by MC-ICP-MS will be developed for various environmental matrices in order to evaluate the possibility of identifying and discriminating Ag and Ag-NP sources and follow their environmental route using their isotopic compositions. In addition of being complementary to the "nanosafetycluster" group, promoting studies on the environmental impact of NP at the European level, the ISOGIRE project is consistent with the priority objectives related to Environment from the work programme with respect to the multidisciplinary approach and development of new monitoring methodologies.

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**NBR: 302603** **ACRONYM: ELECTRON CORRELATION** **EC FUND: 168896**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Electron Correlation - The Electronic Ground State of Graphene Nanoribbons

**Abstract:** Graphene nanoribbons are derivates of graphene. Since its discovery in 2004 by Andre K. Geim and Konstantin S. Novoselov it has received enormous attention earning its discoverers the 2010 nobel prize. The great interest in graphene originates in its unique properties. Graphene nanoribbons are an interesting building block for spintronics. In standard electronics the information carrier is the charge (the electron). When a charge current is present the signal is “on”, when there is no charge current the signal is “off”. In this setup the spin information (“up” or “down”) is completely ignored. Graphene nanoribbons, however, offer the possibility to add the spin degree of freedom to conventional electronic devices. The advantages are numerous. It has been shown theoretically that electrons localise on the sides of nanoribbons. This electronic structure is reminiscent of the electronic structure of the H2 molecule at dissociation limit. The dissociated H2 molecule is the prototype system of static correlation. In this project recently developed theories and methods that accurately describe static correlation are applied to graphene nanoribbons. To investigate the electronic ground state structure with an efficient implementation of the theories and methods will be developed. In this project Prof. Angel Rubio, scientist in charge and head of the nano bio Spectroscopy group at the at the Basque Country University (UPV/EHU) in San Sebastian, Spain, Prof. Gustavo Scuseria, head of the quantum chemistry group at Rice University in Houston, USA, and Dr. Daniel Rohr, researcher in the project, join forces to investigate the electronic structure of graphene nanoribbons. The project will be executed by Dr. Daniel Rohr. He will join the group in Spain for 24 months during which he will spend approximately 6 months in Houston.

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**NBR: 302638** **ACRONYM: BAN-CANCER** **EC FUND: 209033**

**DG:** REA **Call: FP7-PEOPLE-2011-IIF** **Thema:** FP7-PEOPLE-2011-IIF

**Title:** Smart Bandage for Cancer Margin Theranostics

**Abstract:** Successful surgical treatment of breast cancer crucially depends on accurate detection of the boundaries between malignant and healthy cells (tumor margins) and is a major determinant of patient survival. The current standard for assessment of margins is the evaluation by the surgeon in the operating room followed by histological sampling. The project “smart BANdage for CANCER margin theranostics” (BAN-CANCER) combines diagnosis of malignancy at the single cell level over a large area with stimuli-responsive delivery of therapy in a theranostic device for intraoperative detection and eradication of malignant cells at breast tumor margins. BAN-CANCER is a multidisciplinary project that combines the potential of nanoscale materials with a novel theranostic approach. It constitutes a leap forward with respect to current and proposed diagnostics, allowing to diagnose and treat breast carcinoma margin involvement for the first time (i) intraoperatively (ii) at the single cell level (iii) over the entire surgical incision; in a (iv) simple, (v) inexpensive,(vi) biocompatible package; that can be (vii) routinely employed by surgeons without requiring (viii) added equipment or (ix) prolonged analysis. BAN-

CANCER will consist of a vertical array of porous silicon nanoneedles sticking out from a flexible substrate over several square cm. The gauze will be applied over the margins of the remaining breast epithelium following tumor excision allowing the nanoneedles to penetrate within each cell. The needles will be functionalized to release a fluorescent chemotherapy drug in response of abnormal cytosolic protease activity to provide simultaneous imaging and eradication of cancer cells. When the gauze will be removed the surgeon will assess the extent of margin involvement and make an informed decision extending the excision. The intracellular release of chemotherapy will ensure the death of isolated, difficult to observe cancer cells, further preventing recurrence.

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**NBR: 302639** **ACRONYM: ENPHOC** **EC FUND: 200371**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Environmental & Dynamical Effects in Computational Photochemistry

**Abstract:** The use of light pulses in chemistry offers the perspective to finely control atomic and molecular motion in a way that not only redefines the vision of a chemical reaction in itself, but also opens a broad new field of applications and functional device miniaturization, generically called nanotechnology. In order to deliver upon this promise, it must be possible to accurately predict, not only individual molecular behaviour of excited states, but also its time evolution and how this behaviour is changed through the interaction of the molecule with its environment. The aim of the current proposal is to go beyond the individual molecule static picture, and advance our knowledge on the dynamics of photochemical systems and the effects of an environment upon them, but also to consolidate methodology and procedures that allow predictability and transferability of simulation results. This will be done by systematic comparison and assessment of different simulation methods at distinct levels of theory. This proposal combines high level electronic structure calculations and state of the art dynamics simulation methods to study the photochemical reactivity of Protonated Schiff Bases, a prototypical cis-trans isomerizing system, relevant for many photobiological processes. Namely the effect of a solvent environment on the reaction paths of multiple izomerization and on the extended crossing seam will be studied in detail. Dynamics of the system will be studied, using quantum dynamics and QM/MM methodologies, for the individual molecule and the environment. This proposal builds upon the highly complementary skills of the researcher in solvent effects and non-adiabatic dynamics, and the expertises of one of the world leading research groups in the development of electronic structure solutions in photochemistry. The training provided by the fellowship will empower the researcher with a very complete set of tools which will be instrumental in achieving professional maturity.

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**NBR: 302657** **ACRONYM: UPNEX** **EC FUND: 192956**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Ultrafast phenomena in nanoparticle excitations

**Abstract:** The proposed research aims at the investigation of ultrafast nanoparticle excitations, especially in the sub-10-fs domain. To this end, state-of-the-art controlled optical waveforms will be used with pulse durations comparable to the oscillation cycle of light. These sources have been enabling breakthrough achievements in ultrafast science in recent years and the extension of their use in nanoplasmonics also promises novel results. I plan to investigate ultrafast, coupled propagating and localized plasmonic modes via spatially and spectrally resolved photoelectron emission from the nanostructured metal sample as well as scaling effects with femtosecond sources having different wavelengths (800 nm and 1800 nm). Ultrafast photoemission from closely spaced, coupled nanoparticle pairs will also be investigated. With these setups, both quantum and classical effects can be investigated on the photoemitted electrons. These experiments will be enabled by state-of-the-art femtosecond sources, high-resolution electron spectrometers and nanofabrication methods available at the host institute. These will be ideally complemented with my know-how of the applicant in femtosecond technology and ultrafast photoemission experiments. The extension of this know-how towards nanoscience is an expected benefit as a result of the research stay.

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**NBR: 302717** **ACRONYM: SMART NANOGELS** **EC FUND: 167390**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Stimuli-responsive theranostic nanogels based on hyperbranched polyglycerol

**Abstract:** Recent advances in medicine and biotechnology have prompted the need to develop nanoengineered delivery systems that can encapsulate a wide variety of novel therapeutics. Moreover, these delivery systems should be “smart”, such that they can deliver their payload at a well-defined time, place, or after a specific stimulus. The ideal drug delivery system should be biodegradable and biocompatible, should benefit from an active and passive targeting, should target only the desired cells, and should release its cargo (high loading capacity) at the desired intracellular space. In addition, recent trends in nanotechnology have developed the concept of theranostic, i.e., imaging, therapeutic and diagnosis in one. To date, only a few examples of nanocarriers that fulfil all of these criteria have been reported and therefore this research field still remains almost unexplored. In addition, the application of all these concepts to polymeric nanogels constitutes nowadays a challenge, and the achievements of the proposed

objective will pave the road for future biological and biomedical applications of these polymeric systems.

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**NBR: 302782** **ACRONYM: STEM CELLS COCOONING** **EC FUND: 181418**

**DG:** REA **Call: FP7-PEOPLE-2011-IIF** **Thema:** FP7-PEOPLE-2011-IIF

**Title:** Stem Cell Cocooning for Targeted Cardiac Cell Therapy

**Abstract:** Stem cell therapy is believed to be the most viable method for restoration of cardiac function after Myocardial Infarction (MI), the leading cause of death in Europe. Despite numerous attempts at injecting stem cells into post-MI heart to affect regeneration, the consensus is that anoikis (cell death) induced by the lack of contact between the cells and the tissue scaffold during injection, the harsh environment at the injection site, and powerful myocardial contractions cause massive cell loss rendering the therapy ineffective. The goal of this project is to enhance treatment efficacy by individual cocooning of bone marrow stem cells in bioengineered collagen-based microspheres. The cocoon provides the tissue support for cell survival, promotes integrin upregulation for better engraftment of the cells onto the heart tissue, and protect the cells from the harsh post-MI environment. The spheres will be grafted with recognition moieties for the infarct areas, e.g. NGR peptide to enhance targeting. They will also contain growth factor VEGF to promote re-vascularization of ischaemic areas, and gold-coated silicon nanoparticles for in vivo tracking. The cocooned cells will be tested in vitro for their safety and efficacy (e.g. spheres degradation rate, cytotoxicity), and in vivo in MI mice models for their effectiveness in restoring heart functions by echocardiography, and for their traceability by dual-energy CT. As a Canadian researcher, I already joined the Liedberg group at Linkoping University, Sweden, in March 2011 as an Assistant Professor on a temporary, short-term basis to establish this project. My expertise in biomaterials and cell encapsulation combined with peptide, nanoparticle, and imaging expertise of the host laboratory are an excellent match for the success of the project. If the funding is granted, it enables me to extend my stay in Sweden to meet the goals of this beneficial project that will enhance collaborative research between Europe and Canada.

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**NBR: 302902** **ACRONYM: QUANTUM METROLOGY** **EC FUND: 271943**

**DG:** REA **Call: FP7-PEOPLE-2011-IOF** **Thema:** FP7-PEOPLE-2011-IOF

**Title:** Measuring Magnetic Monopoles Using Quantum Metrology in Diamond

**Abstract:** This proposal seeks to develop state of the art quantum metrology in diamond to probe a magnetic monopoles in spin ice. It will accomplish this by establishing an

interdisciplinary collaboration between two world-leading groups, the Yacoby group at Harvard and the Bramwell group at the London Centre for Nanotechnology at University College London. Since the Harvard group purchases the diamond samples commercially, and this fellowship will allow the transfer of their expertise, it offers a particularly sustainable route to the permanent integration of the knowledge in the EU. The results of this fellowship promise to be extremely intersting from both a fundamental and technological perspective, and it is expected to lead to several high profile publications.

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**NBR: 302937** **ACRONYM: TOPOSPIN** **EC FUND: 263660**

**DG:** REA **Call: FP7-PEOPLE-2011-IOF** **Thema:** FP7-PEOPLE-2011-IOF

**Title:** Scanning tunneling spectroscopy of topological interfaces for future spintronics

**Abstract:** In the last thirty years great progress in solid state physics was mainly driven by the discovery of novel highly unique material systems. Materials such as high tc superconductors, carbon nanotubes, semiconductor nanowires and graphene reshaped our understanding of modern solid state physics. In particular, each of these materials opened a new chapter in the multidisciplinary fields of nanotechnology and nanoscience. In this context, recently discovered topological insulators, a remarkable new material system, has at least the same potential. The unique properties of these materials such as topological protection of the surface states, transport channels and spin textures that arise due to non-trivial band structure promise to open new areas of quantum computing and spintronics. Moreover, these materials may even solve some long standing puzzles arising from fundamental quantum mechanics and elementary particle physics. This fellowship will enable transfer of knowledge of topological insulators from the world leading group in the field at the Princeton University, to the arguably best groups in Europe.

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**NBR: 302964** **ACRONYM: ESBCO2** **EC FUND: 183658**

**DG:** REA **Call: FP7-PEOPLE-2011-IOF** **Thema:** FP7-PEOPLE-2011-IOF

**Title:** Electrosynthesis of biofuels from gaseous carbon dioxide catalyzed by microbes: A novel approach/quest of microbe-electrode interactions

**Abstract:** An increase in atmospheric CO2 derived from combustion, the rising prices of crude oil, and the diminishing supply of fossil fuels poses great challenges to worldwide sustainability. Thus, the necessity of developing greenhouse gas mitigation technologies and biobased renewable energy sources is very urgent. Microbial electrosynthesis (MES) exploits the ability of microbes to make electrical contacts with electrodes and other

cells and the production of biofuels with such microbial electrosynthesis is of great interest. However, mechanisms by which microorganisms conserve energy to maintain cells and support growth when directly accepting electrons for MES from electrodes is not explored yet. Moreover, information on carbon and electron flow during CO2 reduction to biofuels at a cathode is not yet fully explored. Thus, MES needs to overcome several microbial, electrochemical and technical challenges. This IOF will contribute to the development of a cost effective alternative to current fuel production, using greenhouse gas CO2 (model pollutant) as a feedstock. This IOF will use new concepts dealing with the better understanding of electron (e-) transfer/exchange, surface engineering conductive biofilms, system biology/genomics, genomic tools, nano-networks and novel materials and practical implications of these concepts for environmental clean-up and the development of renewable energy sources.The proposed IOF will provide a tool for the EU Directive 2009/28/EC of the European Parliament and of the Council of 23rd April 2009 on the promotion of the use of renewable energy, and also falls into the category of EU climate and energy policies, and Europe Horizon 2020 strategy demanding climate and energy targets to be met by 2020 for smart, sustainable and inclusive growth. This IOF project will a investigate and develop a technology for the conversion of CO2 (greenhouse gas) into biofuels and will play an instrumental role in achieving a healthy environment.

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**NBR: 302989** **ACRONYM: JANUS FERROELECTRICS** **EC FUND: 192622**

**DG:** REA **Call: FP7-PEOPLE-2011-IIF** **Thema:** FP7-PEOPLE-2011-IIF

**Title:** Janus Nanoparticles as Novel Ferroelectric Materials

**Abstract:** The goal of this proposal is the generation of new ferroelectric materials based on bifunctional monolayer-protected metal nanoparticles (MPMNs) and supracrystals based on these anisotropic MPMNs. These Janus nanoparticles, named such for their characteristic pair of hemispherical faces, are expected to exhibit novel ferroelectric properties due to their inherent non-centrosymmetry and resulting permanent dipole. In addition, these MPMNs are expected to exhibit superparaelectric properties. This research will create the first such materials using several combinations of ligands in the protecting monolayer, such as alkanethiols and fluorinated alkanethiols. The work will begin with a systematic study, allowing optimization of synthetic parameters for forming Janus MPMNs. The ferroelectric properties of these Janus nanoparticles will be unlike any observed for MPMNs previously, due to their ubiquitous centrosymmetry and corresponding lack of a permanent dipole. Furthermore, the properties observed will be novel with respect to existing ferroelectrics due to its composition of nonferroelectric metals and organic ligands. Components with inherent ferroelectric properties, such as BaTiO3 and vinylidene fluoride, will then be integrated into the anisotropic materials. The integration of natively ferroelectric components into a system with emergent ferroelectric properties is expected to produce entirely novel multiferroic materials. The

assembly of Janus MPMNs into supracrystals will also be explored in detail. The assembled supracrystals are expected to exhibit non-centrosymmetry, yielding a second class of novel ferroelectric and piezoelectric materials Ferroelectric materials can also be integrated into these supracrystals, yielding products with more complex and tunable properties.

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**NBR: 302991** **ACRONYM: DECIMA** **EC FUND: 278807**

**DG:** REA **Call: FP7-PEOPLE-2011-IIF** **Thema:** FP7-PEOPLE-2011-IIF

**Title:** Detection and Characterization of Individual Micro- and Nanoparticles

**Abstract:** The Project aims to develop novel approaches for detection and characterization of particles in the critical nanometer – micrometer size range. An improved knowledge of the make-up and origin of such particles that are present in the atmosphere and working environments is crucial for understanding their role in atmospheric pollution and human health. The role of atmospheric particles in influencing climate behavior is also poorly understood and requires more sophisticated analysis techniques. The detection of neutral isolated nanoparticles is an extremely challenging problem. The compositions and structures of particles present in the atmosphere are largely unknown owing to limited measurement capabilities. Recently it has been shown that femtosecond laser ablation is a promising technique for nanoscale depth-resolved chemical analysis while graphene nanoresonators offer much promise as ultrasensitive mass detectors. This multidisciplinary Project includes two key areas that could revolutionize particle monitoring: (1) depth-resolution analysis of micro- and nanoparticles using fs laser ablation mass spectrometry and (2) the combination of nanoelectromechanical mass sensing and fs laser ablation mass spectrometry for the detection and elemental analysis of neutral nanoparticles. A dual time-of-flight mass spectrometer will be constructed for analysis of individual aerosol particles. The potential of fs-laser ablation mass spectrometry for providing a particle depth profile will be explored and tested on well-defined core-shell micro-/nanoparticles. In addition, the elemental analysis potential of fs laser ablation mass spectrometry will be coupled with sensitive neutral particle detection, using a graphene-based mass sensor that will be developed in the host group. The outcome of the Project will be in making an important step from fundamental concepts of particle detection and characterization to laboratory proof-of-principle studies and prototype development.

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**NBR: 303029** **ACRONYM: QPOS** **EC FUND: 184709**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Quantum Phenomena in Optomechanical Systems

**Abstract:** Cavity optomechanics is a flourishing research field concerned with the study of macroscopic objects in a regime where quantum mechanical effects become apparent. A strong interaction between the optical field and the mechanical motion of optomechanical resonators, usually mediated by radiation pressure, enables both new photonic technologies as well as fundamental experiments that are at the heart of quantum mechanics. This proposal aims to study micro- and nano-optomechanical systems cooled close to their ground state of motion to advance both fundamental and applied concepts in quantum optomechanics. A first aim is to study a recently developed optomechanical device based on a 2D photonic crystal defect cavity. In particular, we aim to cool this device down to its ground state of motion by embedding it in a Helium-3 cryostat and using radiation pressure induced laser cooling to reach its ground state of motion. The high optomechanical coupling strength measured on these devices promises to allow ground state cooling with moderate efforts. A second objective is to implement the technique of motional side-band spectroscopy, adapted from ion trapping experiments, to characterize the degree of occupancy of the ground state of motion of optomechanical resonators, providing a definite quantum-mechanical signature in these macroscopic objects. Finally, we will use the recently observed effect of optomechanically-induced transparency (OMIT) in microresonators, in which the optomechanical coupling induces a very narrow transparency window accompanied by a strong group velocity reduction, for storing and stopping light pulses in optomechanical modes. This proposal will allow the applicant, a physicist recently graduated with distinction from the Institute of Photonic Sciences (ICFO) in Barcelona, to join the Laboratory of Photonics and Quantum Measurements in the Federal Institute of Technology in Lausanne (EPFL), a group with high recognition in this field of research.

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**NBR: 303069** **ACRONYM: NANOPDT** **EC FUND: 268555**

**DG:** REA **Call: FP7-PEOPLE-2011-IOF** **Thema:** FP7-PEOPLE-2011-IOF

**Title:** Efficient Tumor Targeting and Therapy Using Near-Infrared Nanoparticles

**Abstract:** Photodynamic Therapy (PDT) is a clinically approved cancer treatment relying on the use of a photosensitizer, i.e., a fluorescent molecule producing cytotoxic species upon irradiation with light. PDT also provides the ability to image and locally treat diseased tissues without ionizing radiations, thus sparing healthy tissue. Yet, only five photosensitizers are now approved for clinical applications and all suffer from serious drawbacks, including low selectivity and skin sensitization. Photosensitizer-loaded nanoparticles could potentially solve these problems. They can accumulate at the site of tumors by either passive or active targeting. Their physicochemical properties can also be tuned to accelerate clearance, and reduce non-specific binding. In this study, we propose to investigate a novel class of polymer-based organic nanoparticles whose most

relevant physicochemical properties can easily be tuned by controlling synthesis parameters. Benefiting from expertise of researchers at the Beth Israel Deaconess Medical Center (Boston, MA, United States), the research fellow will design a wide range of polymer fluorescent nanoparticles. These particles will be tested to find a formulation with optimal blood half-life, low non-specific binding and good targeting capabilities. The research fellow will then synthesize and test the most efficient particles at the Institut Albert Bonniot (Grenoble, France) on head and neck tumor rodent models using 2D and 3D fluorescence imaging. The PDT efficacy will be monitored by following tumor growth and survival rate of the animals. This fellowship application has the potential to solve a longstanding problem in PDT while providing outstanding international training and promoting the career of a talented European researcher.

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**NBR: 303140** **ACRONYM: MICRONANOTOX** **EC FUND: 209033**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Microbial community nano-ecotoxicology: interplay between effects on structure and the consequent effects on function.

**Abstract:** Nanotechnology is already used in a huge variety of applications with a resulting potential environmental exposure. However, we are still lacking sound scientific knowledge on the ecological consequences for natural environmental systems of exposure to man-made nanoparticles (NPs). While standard ecotoxicity tests can be modified for hazard assessment of such NPs, the tests and therefore the conclusions address the wrong endpoints such as high-dose effects on survival and reproduction. This may have little relevance to possible effects on structure and function of natural ecosystems predicted to be exposed to low doses. Therefore the overall aim of this project is to link modern molecular biology and nano-ecotoxicology to address the interplay between effects of engineered NPs on microbial community structure and function and the consequent effects on their ecosystem function roles and rescilience. By joining the disciplines of community ecotoxicology, modern molecular biology, high end NP characterisation techniques together and bringing their combined abilities to bear on natural microbial comunities collected from both aquatic and soil environments this project will contribute to an environmentally more realistic hazard and risk assessment of NPs for microbial communities. This project will use both true commercial and purpose designed examples of silver (Ag)- and zinc oxide (ZnO)-NPs both NP types being among the commercially most important NPs these days. An additional focus will be set on systematic investigations of how effects are governed by the NPs fate and behaviour in relation to the respective environmental matrix and crucial abiotic key factors. The data will be submitted into a broader research context through major EU and UK-US projects analysing the environmental effects and hazards of NPs to contribute to the development of suitable hazard and risk assessment strategies for the special demands of NPs.

**NBR: 303228** **ACRONYM: NOLACOME** **EC FUND: 261853**

**DG:** REA **Call: FP7-PEOPLE-2011-IOF** **Thema:** FP7-PEOPLE-2011-IOF

**Title:** Nonlinear Optics and Lasing in Complex Media

**Abstract:** The past decade has witnessed a stupendous growth in research activity on the way we control the flow and storage of photons. This activity has been, to a large extent, driven by the enormous progress in micro- and nano-fabrication capabilities of photonic media. The presented proposal aims at a theoretical and computational study of Non-linear optics and Lasing in Complex Photonic Media, enabled by this capability. The complexity of these media stems from their non-trivial spatial structure which is required for the control of electromagnetic radiation in various applications like novel micro- and nano-lasers. The proposed research will focus on four main topics: the role of a spatially non-uniform pump/gain medium in laser characteristics and its interplay with the resonator geometry for the design of compact and power-efficient lasers; lasing in Parity-Time (PT) symmetric cavities and its relation to unidirectional invisibility and the anti-laser; existence of a statistical signature of Anderson Localization in Random Lasers; theoretical techniques to study collective effects in Non-linear Optics that derive from the complexity in the photonic structure used to confine light. Results from these research activities are expected to have impact both on basic research and on applied technology for the design of novel and improved photonic devices.

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**NBR: 303254** **ACRONYM: TETTRA** **EC FUND: 184709**

**DG:** REA **Call: FP7-PEOPLE-2011-IEF** **Thema:** FP7-PEOPLE-2011-IEF

**Title:** Towards Enhanced III-V Tunnel Transistors

**Abstract:** Tunnel transistors are currently considered promising candidates for future low-power high performance information processing applications. The proposed project TETTRA – Towards Enhanced III-V Tunnel TRAnsistors – is dedicated to the fabrication and characterization of III-V nanowire tunnel field-effect transistors (FETs). III-V semiconductor heterostructure nanowires, grown on Si substrates by means of the selective-area-epitaxy method, serve as basis for the tunnel FETs. The project concentrates on n-type tunnel FETs and furthermore focuses on one specific realization with regard to the choice of materials involved; i.e. n-type tunnel FETs consisting of a p-type GaSb source, an InxGa1-xAs channel, and an n-type InAs drain. This sequence of III-V materials is grown in the form of vertical heterostructure nanowires directly on silicon substrates, with InAs being in contact with the substrate and GaSb forming the nanowire

tip. The heterostructure nanowires are then processes into vertical, gate-all-around tunnel FETs. The fabrication of the nanowire heterostructure and the processing of the III-V nanowire tunnel represent one of two main objectives of the project. Investigations on the growth of GaSb on InxGa1-xAs, on the p-doping of GaSb, and on metal contacts to GaSb are preceding the tunnel FET fabrication. The second objective of the project comprises the electrical characterization of the nanowire-oxide interface properties and the electrical characterization of III-V tunnel FETs. For characterizing the nanowire-oxide interface properties two independent techniques will be employed: capacitance-voltage measurements and the charge-pumping technique. Both deliver the interface trap level density, Dit, and both have been demonstrated to be applicable to single nanowire capacitors and FETs, respectively. Characterization is complemented by detailed investigations of the electrical properties of the III-V nanowire tunnel FETs.

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**NBR: 303308** **ACRONYM: SIXPAC & T-REX** **EC FUND: 212513**

**DG:** REA **Call: FP7-PEOPLE-2011-IOF** **Thema:** FP7-PEOPLE-2011-IOF

**Title:** Single-shot X-ray Pulse duration Acquisition (SiXPAc) & Time-Resolved X-ray spectroscopy on molecules (T-ReX)"

**Abstract:** Three-dimensional (3D) imaging techniques to investigate the spatial composition of crystalline materials and biological specimens have over the last decades been steadily refined to their current nano-scale resolution. However, nearly all of the methods relying on X-ray or electron 3D tomography only deal with static samples and cannot convey simultaneous information about structural changes. One very promising approach in this direction is to make use of ultrabright state-of-the-art X-ray sources, so-called free-electron lasers (FELs), which routinely produce coherent X-ray radiation with unprecedented intensities. Combining the high spatial and ultrashort temporal resolution of X-ray pulses for a full 4D characterization of the complex samples has been a long-standing goal of material and biological science. Due to the ultrashort duration of FEL pulses currently no measuring technique is able to precisely determine their time structure. The first step of this project at the LCLS will demonstrate a technique capable of measuring the X-ray pulse duration for every single shot with a precision of a few 100 attoseconds utilizing photoelectron streaking spectroscopy. This method will in addition permit us to directly investigate the substructure of the FEL pulses on an attosecond time-scale. In the second step we want to apply these pulses for time-resolved X-ray absorption spectroscopy: A UV pulse initiates a molecular reaction and the X-ray pulse is used as a probe, in effect sampling the dynamics of the complex system in real-time. The project would firstly greatly profit from the knowledge on ultrafast optics the applicant acquired over the past 4 ½ years at the MPI of Quantum Optics and secondly provide him with first-hand experience in the novel field of FELs at the most renowned accelerator facility worldwide, strengthening the applicant's scientific profile

substantially, especially in the context of the upcoming European X-Ray Free-Electron Laser (XFEL).

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**NBR: 303535** **ACRONYM: CHROMSENSUC** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** Chromophore-Sensitized Up-Conversion in Lanthanide Materials

**Abstract:** This proposal seeks to demonstrate and understand a new class of materials for up-converting infrared (IR) radiation into the visible range through linear radiation-matter interactions, exploiting the optical and electronic properties of trivalent rare-earth ions and organic-based light harvesting compounds. It is known that materials doped with lanthanide ions are capable of combining low energy excitations into higher states via excited state absorptions and energy transfer, resulting in visible or UV emission upon IR excitation. However, the primary absorptions are partially forbidden, which results in a low performance or the requirement of relatively high exciting power. Our aim is to exploit the fact that organic chromophores can have very high absorption coefficients, several orders of magnitude greater than the lanthanide ions, and can act as primary sensitizers by transferring the excitation to them, thus providing an effective increase in absorption and hence, in up-conversion. Following recent discoveries on the nature of the organics to be employed towards this end, we will pursue a twofold strategy. On one hand we will study up-converting organolanthanide polymers incorporating IR chromophores and on the other hand, hybrids based on well known, efficient lanthanide-doped inorganics in combination with IR absorbing organic dyes. The inclusion of chromophore-containing dyes will be done though chemical methods during the synthesis or via coating of nanostructures to exploit inter-molecular and inter-domain energy transfer. We will aim at design rules through opto-structural correlations derived by spectroscopic and characterization experiments at ambient and high pressure of the un-sensitized and sensitized materials. The study and approach are expected to impact on the multidisciplinary Material Science community due to the applications in optical and solar cell technologies as well as Biology due to potential uses in labeling and therapy.

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**NBR: 303559** **ACRONYM: IMANILBCAT** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** Interferometric Microscopy and Nanoscopy in Live Biological Cells and Tissues

**Abstract:** The current research proposes new optical spectroscopic and interferometric microscopy and nanoscopy techniques for accurate measurements and visualization of biological cell structure, organization, stiffness and dynamics by recording the cell spatial, temporal, and refractive-index structure on sub-wavelength and sub-Hertz scales. The following objectives are proposed: (a) Novel optical-mechanical signatures of cancer cells measured by wide-field digital interferometry: I propose to establish multi-disciplinary cancer biomarker using the stiffness signatures of cancer cells measured in a noncontact, quantitative and label-free manner by wide-field digital interferometry (WFDI). (b) Interferometric and spectroscopic diagnosis of red blood cell diseases: I propose to measure mechanical and morphological properties of live red blood cells (RBCs) with extremely high sensitivity in a non-destructive, noncontact and label-free manner, as a mean to learn about the biomechanical properties of the RBC membrane and as a novel diagnosis tool for diseases that change morphology and mechanical properties of RBCs. (c) Developing plasmonic-nanoparticle-based interferometric methods for Alzheimer's disease research: I propose to develop new nano-sensing and imaging modalities as a means to monitor degradation of neuronal function due to Alzheimer's disease. I will use photothermal optical coherence tomography with nanoparticles bound to amyloid beta to detect the degeneration in neuronal activity. This system will be combined with a low-coherence WFDI system for quantitative phase imaging of rapid dynamic neuronal phenomena. The proposed objectives are highly interdisciplinary, involving optical engineering, sensing in biological systems, biophysics, nanoscience, neurobiology, and disease research, and have a great potential of providing new means for diagnosis and monitoring of diseases in the sub-cellular level, as well as aiding in identifying new avenues for therapy.

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**NBR: 303620** **ACRONYM: IMAGINDNA** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** Advanced DNA imaging: improving spatial resolution and contrast through photoswitching

**Abstract:** Fluorescence microscopy is one of the most convenient and widespread tools used in the life sciences. An important challenge, however, is to improve its spatial resolution, which is limited to about 200 nm. Recent “super-resolution” techniques such as photoactivation-localization microscopy (PALM) can provide images with a spatial resolution of tens of nm. Most studies performed with these techniques have imaged the nanoscale distribution of proteins. However, little progress has been seen on DNA super-resolution imaging due to challenges in labelling. My main research is aimed at exploring new ways to label DNA in high density with photoswitchable fluorophores and improving spatial resolution in fluorescence microscopy. This will allow opening up new opportunities to study a broad range of problems in Biology and Nanoscience. My recent work has shown that PALM-like imaging of DNA can achieve a spatial resolution below

40 nm by using intercalating cyanine dyes in combination with a buffer that promotes photoblinking. This proposal aims at optimizing this approach, and at finding new alternatives for DNA super-resolution imaging. I propose two research lines: 1) Use correlative atomic force microscopy and PALM-like imaging to optimize the above methodology. As first targets, DNA origami will be used. Correlative microscopy will then be applied to study chromosome structure; 2) Study the photophysical properties at the ensemble and single-molecule level of a new material, CyDNA (DNA highly substituted with cyanine dyes in a controllable way). Bringing together Cy3 and Cy5 dyes in the same CyDNA with high density results in a photoswitch with new properties. CyDNA photoswitching will be used for super-resolution imaging in combination with fluorescence in situ hybridization, and also to improve image contrast with optical lock-in detection imaging. Further opportunities to apply the developed methodology will also be identified throughout the fellowship

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**NBR: 303630** **ACRONYM: 3DINVITRONPC** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** Interactions in Three-dimensional (3D) in vitro environments of Nanoparticles and Cells

**Abstract:** The applications for nanoparticles (NPs) in medicine have rapidly increased in recent years; some examples are drug delivery, medical imaging, in vitro biosensors and cancer treatment. Typically, the biological assessment of NPs is carried out first in vitro (in a 2D petri dish) and then in small animals in vivo (3D). This whole process is costly and time consuming; similarly to that is required for the drug development, 11-15 years and $500 to $800 million to reach the market. An intermediate step between (2D) in vitro and (3D) in vivo assays could provide relevant information, decreasing the total cost of the biological assessment. 3D in vitro assays mimic biologically relevant tissues in an economical and rapid manner; although, current 3D in vitro methods entail complex engineering steps. 3DinvitroNPC focuses on a simple and innovative strategy to create 3D in vitro cell cultures using sheets of porous materials and embedding living cells and NPs within those materials. 3D cell cultures require a material non-toxic for cells and highly porous to allow cells to grow within its microstructure. This project explores aerogels of biomaterials to create 3D in vitro novel scaffolds that are biodegradable and transparent. Combinations of cells and NPs in the 3D in vitro constructs permits the assessment of viability and functionality of NPs in relevant biological environments which is critical for using NPs in medical applications. Gold NPs and FexOy-NPs will be assessed, the first as model NPs and the latter as magnetic label of cells. FexOy-NPs internalized by cells, magnetically label the cells. Localization of magnetic cells using a magnet placed outside the body is a recently developed medical method non-invasive for tissue recovery after cerebral ischemia. For this purpose, the platform of 3DinvitroNPC will evaluate magnetic cells within the on-purpose developed 3D cell scaffolds.

**NBR: 303688** **ACRONYM: NANOWGS** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** Water-gas shift reaction on metal-oxide nanocatalysts for hydrogen production

**Abstract:** Hydrogen is a clean energy carrier, which used in highly efficient energy conversion technologies such as fuel cells, has the potential to satisfy many of our future energy needs in a sustainable way. The water-gas shift (WGS) reaction (CO + H2O -->H2 + CO2) is a critical process in providing pure hydrogen for catalytic processes in the chemical industry and fuel cells. Nevertheless, the design and optimization of WGS catalysts depends on a better basic understanding of catalyst structure and function. New generation WGS catalysts are base on metal-oxide bifunctional systems with the metal and oxide catalyzing different parts of the reaction. The aim of this project is precisely to understand and optimize the performance of the metal and oxide phases in order to develop the ability to predict, and ultimately design, improved cost-effective WGS catalysts. To this end, we propose to create models for these catalysts and apply state-of-the-art computational chemistry methods. We will apply first principles calculations to understand the nature of the active sites in each component of the catalysts and determine how they interact with the reactants and possible intermediates of the WGS reaction. We will be able to establish why metal particle size matters for this reaction and why some metals or oxides are better than others. Calculations will be performed for catalysts that have been studied in detail by our experimental colleagues, making them more meaningful. Theory will not only be used for the explanation of experimental data, but also for pre-screening the behavior of catalysts. Overall, our approach will develop basic principles for the rational design and optimization of WGS nanocatalysts vital for the production of clean hydrogen. These studies will contribute to the long-term goal of the EU of developing new concepts for a better use of chemical processes and materials associated with energy-related problems.

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**NBR: 303689** **ACRONYM: SPINKOND** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** Spin effects in transport through magnetic nanostructures in the Kondo regime

**Abstract:** The unavoidable limitations of further miniaturization of electronic circuits stimulate the search for new information and storage technologies. Spintronics is one of the major new directions that emerged in recent years - it aims at using the additional degree of freedom, namely the spin, to store and process information. One of the most promising

candidates for future spintronics devices are nanostructures such as molecules and quantum dots. However, in order to exploit such devices in spin nanolelectronics, it is crucial to fully understand their behaviour and properties. The main objective of this research project is to gain further insight into spin-resolved transport properties of complex quantum dot and molecular structures coupled to leads exhibiting either ferromagnetic or superconducting correlations. The emphasis will be put on the strong coupling regime, where electronic correlations lead to the Kondo effect. In particular, the considerations will include the analysis of the SU(4) Kondo effect in double quantum dots and carbon nanotube dots and thermoelectric effects in spin-resolved transport through Kondo quantum dots and molecules. The transport characteristics of hybrid quantum dots, in which one of the leads is ferromagnetic while the other one is superconducting, will be also considered. All these nanostructures have become particularly interesting in view of recent experiments. The calculation of transport properties will be performed by using the numerical renormalization group methods with state-of-the-art improvements – these are known as the most powerful and exact methods to address transport through quantum dot and molecular systems. The results obtained will provide new insight and understanding of current and future experiments on transport through various magnetic nanostructures in the Kondo regime. They will be also published in refereed scientific journals and presented at international conferences and workshops.

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**NBR: 303710** **ACRONYM: NW CARDIAC TISSUES** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** Nanowired Scaffolds for Cardiac Tissue Engineering

**Abstract:** Ischemic heart disease (IHD) is the most common cause of death in the Western world, accounting for more than 741.000 deaths each year in the European Union with yearly costs in excess of € 45 billion. Myocardial infarction (heart attack; MI) captures a significant segment of IHD population and is associated with sudden death as well significant morbidity and mortality. Currently the only cure for end-stage heart failure is cardiac transplantation. As cardiac donors are scarce, there is an urgent need to develop new strategies for regeneration. One experimental approach to treat defected organs is tissue engineering. Engineered cardiac patches to replace scar tissue after MI are produced by seeding cardiac cells within 3D biomaterials. However, success of this approach can be jeopardized by a lack of supporting microenvironment for the organization of a thick tissue and lack of electrical conductivity within the construct, both leading to impaired electrical signal propagation. Another limitation is the lack of an appropriate cell source. In the current proposal we first aim to engineer a 3D microenvironment mimicking the natural ECM of the myocardium. This synthetic matrix will be embedded with gold nanowires to increase electrical signal propagation between cardiac cell bundles. In the second step the ability of this unique microenvironment to

support the culture and organization of human cardiac stem cells to a functional mature tissue will be explored. Finally, we will investigate the potential of the nanowired cardiac patch to improve the infarcted heart function. The proposed study has a potential to present a breakthrough in tissue engineering, and could help develop conductive cardiac patches to replace scar tissue after MI and repair congenital heart diseases. Moreover, the approach proposed here could even allow an entirely new strategy to repairing damaged cardiac conduction systems.

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**NBR: 303779** **ACRONYM: LBL OF CNTS FOR SCS** **EC FUND: 75000**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** Preparation of ITO free transparent conductive electrode via layer-by-layer deposition of carbon nanotubes and its application for solar cells

**Abstract:** The objective of this work is to prepare ITO free transparent conductive electrodes on glass and polyethylene terephthalate (PET) substrate via layer-by-layer deposition (LBL) of carbon nanotubes (CNTs) and to utilize the prepared electrode for solar cell devices. First, CNTs will be chemically functionalized with carboxylic acid and amine groups. Next, the substrates will be subjected to oxygen plasma etching to introduce hydroxyl groups, followed by immersing in gamma-APS (3-aminopropyltriethoxysilane) solution. Then, CNT multilayer will be formed on the gamma-APS modified substrate via LBL deposition of carboxylic acid and amine functionalized CNTs alternatively. The deposition conditions will be optimized by measuring the sheet resistance and optical transmission and it will be compared with standart ITO values. In addition, film thickness and morphology will be investigated with ellipsometry and AFM, respectively. Moreover, the CNT multilayer film on the substrate (glass and PET) will be subjected to adhesion and chemical resistance test, and to mechanical bending tests for PET substrate. Finally, solar cell device will be fabricated on the CNT multilayer electrode by using commercial photoactive polymers. The electrical properties and device efficiency values will be investigated and compered with the one with ITO coated substrate. Here, I believe that this proposal is very relevant to the work programme since it includes material science, nanoscience, and optoelectronic and energy device application, which are known to be among the core topics of FP7 programme. Also, the CIG programme is very relevant to myself since i started my career in Turkey (associate country of FP7 programme) as a fresh PhD holder after i came back from South Korea, where i resided and completed PhD work.

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**NBR: 303824** **ACRONYM: SUNLIGHT** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** Solution-processed nanocrystal photovoltaics from environmentally benign and earth-abundant elements

**Abstract:** In the search for cost-effective solar cells, colloidal inorganic semiconducting nanocrystals (NCs) have received much interest due to their readily-tunable absorption across the visible/near-IR, their high absorption coefficients and photostability. Yet many state-of-the-art NCs for photovoltaics are either based on toxic compositions or scarce elements on earth. It thus becomes essential to develop new systems from environmentally benign and earth-abundant elements with strong absorption properties. This project identified a few potential candidates, namely FeS2, Cu2S, CuO and Cu2ZnSnS4, due to their low raw material cost, their suitable band gaps, their high absorption coefficients and the availability of NC synthetic protocols. Relatively little work has been done on applying these NCs in solution-processed solar cells compared to those from II-VI/IV-VI groups, the Cu(InGa)(SeS)2 and Si systems. Specifically, this project involves the following aspects: 1. Optimization of synthetic methods for the above-mentioned NC systems. 2. Functionalization of NC surfaces with difference ligands via ligand exchange. 3. Realization of field-effect transistors based on NC thin films and investigation of the effects of NC size/morphology and ligands on charge transport. 4. Realization and optimization of solar cells based on NCs or NC/organic hybrids by correlating the effects of different synthetic and ligand conditions, improvement in light harvesting by the tandem cell approach. It can be anticipated that, by developing solar cells based on these new NCs, this project will gain fundamental understandings on how different NC and surface properties can impact the charge dissociation, transport, and recombination processes. The Marie-Curie grant would also consolidate the current efforts of this applicant, establish her further in her research and provide the ideal platform for her to become internationally leading in the field of applying colloidal NCs in optoelectronics.

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**NBR: 303840** **ACRONYM: 3DNSBT** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** Three-dimensional nanofiber scaffolds as a model for the study of brain tumour migration

**Abstract:** Brain tumours represent a formidable therapeutic challenge. A major obstacle to effective treatment is the fact that many tumours readily invade normal brain preventing complete surgical resection leading to inevitable tumour recurrence. It is difficult to predict invasive potential of individual tumours, there are no drugs currently available that specifically target invading tumour cells, and there is a lack of efficacious models of tumour invasion. In collaboration with colleagues in the USA I have been

involved in the development of a novel in vitro migration assay based on the use of 3D nanofiber scaffolds that stimulate brain tumour cell migration, which we recently used for gene expression profiling to identify novel signaling pathways involved in invasion of the most agressive brain tumour, glioblastoma multiforme. Here, we will further develop this model in three ways. First, we will address the mechanisms involved in glioblastoma migration by profiling microRNA alterations in nanofiber migration assays. After validation of altered microRNAs, their effects on cell migration will be determined in the nanofiber assay, and relevant targets will be identified. The long-term goal of this aim is to identify novel anti-invasive therapeutic approaches. Second, we will investigate the potential of 3D nanofiber scaffolds as diagnostic tools, that may be used to predict the invasive potential of various patient brain tumours. This will be done using patient samples obtained from brain tumour surgeries at Leeds General Infirmary. Invasive potential of tumour biopsies will be determined in the nanofiber assay, and compared with patient progress over time. If there are indications of efficacy, funding will be sought elsewhere to carry out broader trials on large numbers of patients. Such a tool may prove invaluable for clinical decision making. Finally, we will determine the potential of the assay for future high throughput screens.

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**NBR: 303872** **ACRONYM: SUPRABIOMAT** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** Supramolecular Biomedical Materials

**Abstract:** Nanostructured functional materials are undoubtedly one of the main focal points in academic and industrial research communities. Nature's own 'bottom-up' strategy for the construction of immensely complex and sophisticated nanoscaled systems have served as an inspiration for ground-breaking developments in the field of supramolecular chemistry. I aim to combine self-assembly and self-organization for the fabrication of complex supramolecular systems with specific functionality. I propose to use peptide discotics for the controlled self-assembly of supramolecular functional nanoparticles in water and target molecular imaging studies in order to develop Supramolecular Biomedical Materials. I will establish a set of semi-empirical rules, a packing parameter, for the design of supramolecular colloidal particles. The strategy of frustrated growth will aim to balance out positive non-covalent interactions with repulsive forces. Thereby the growth, stability and biocompatible surface functionalisation of the architectures can be controlled, aiming at sizes below 20 nm. The resulting supramolecular materials will be applied in molecular imaging, the development of nanoparticulate targeted and multimodal contrast agents. The elegance and uniqueness of these Supramolecular Biomedical Materials is that following the initial targeting event, the self-assembled scaffolds will disassemble into their small building blocks. This optimises secretion by the renal system and at the same time, the highly 'effective' imaging is also retained because of the high local concentration of the

imaging agent, thus enhancing overall contrast, sensitivity and resolution of for example cardiovascular disease processes. This will significantly reduce the residence times of the targeted agent, which is one of the major limitations in current biomedical applications using non-reversible nanoparticulate imaging.

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**NBR: 303931** **ACRONYM: NANOPOROUSVIP** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** DEVELOPMENT OF NANO-POROUS MATERIALS FOR THE PRODUCTION OF VACUUM INSULATION PANELS (VIPs)

**Abstract:** Vacuum insulation panels (VIPs) offer extremely high thermal resistances properties combined with small thickness that can enhance the energy efficiency of the insulating systems and provide savings in energy consumption. They are generally made with porous core materials wrapped, under vacuum, in airtight films. In the construction of VIP, core materials play a crucial role in thermal performance and mechanical properties of the insulation system. Commonly used core material is fumed silica with nanoporous structure. Core materials with higher porosity and smaller pore size have the greater ability to maintain lower thermal conductivity. However, high product costs are the main obstacle for a broader penetration of the VIPs technology into many applications like cold appliances and building insulations. The main objective of the proposal is to develop cost effective novel nanoporous core materials that can be used as core insulation filler in VIPs, which will help for the widespread usage of this technology for applications in cold appliances and/or building insulations. The nanoporous inorganic materials will be developed using triblock self-assembled polymers (Pluronic® F127) as structure directing compounds. Pluronic forms nano-size micelles and have polar OH end groups that when assembled as a surface can provide slightly negatively charged sites for nucleation of the inorganic phase. After the coating of the nano-size polymeric micelles with the inorganic phase, a porous structure will be obtained when the polymer is removed from the inorganic-polymer composite by calcination. Then, VIP prototypes will be produced with the developed porous core materials and thermal performance at the different vacuum levels will be measured. It is aimed to develop VIP with thermal conductivity of less than 4 mW/m.K. The refrigerator prototypes will also be produced by the integration of the VIPs and various tests with regard to performance and heat losses will be performed.

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**NBR: 303941** **ACRONYM: ANISOKINEQ** **EC FUND: 50000**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** Equilibrium properties and kinetics of self-assembly of anisotropic colloids and molecular liquids

**Abstract:** The proposed research project aims to study self-assembly of new materials made of anisotropic colloids as building blocks and to unravel the mechanism of crystallization in molecular liquids, such as water. The last few decades have seen a huge growth in the research on novel soft materials to be exploited in nanotechnology, and an efficient route to build them is to make use of self-assembly. The term self-assembly refers to the reversible and cooperative assembly of predefined components into an ordered super-structure. Self-assembly is responsible for nanostructure formation in colloidal, amphiphilic, polymeric, and biomolecular materials. However, unlike most of the work of the last decade on particle self-assembly, which has focused on colloidal systems of spherically-shaped particles with isotropic interactions, not enough effort has been put yet into understanding and controlling the self-assembly mechanism in suspensions of irregularly shaped or/and anisotropically interacting colloidal particles (the latter also called "patchy colloids"). Patchy colloids have been recently used to reproduce the colloidal analogue of a vitally important molecule: water. Water is the only known non-metallic substance that expands when freezing. Understanding the mechanism of water crystallisation (or ice formation) is of fundamental interest to many scientific disciplines, ranging from meteorology to food science and biology. However, on the one side length and time scale relevant for water crystallisation are unattainable with up-to-date experimental techniques. On the other side, computer simulations of ice crystallisation have been a great challenge, the difficulty been that hydrogen bonding between individual water molecules yields a disordered three-dimensional hydrogen-bond network that hinder ice formation. Therefore, understanding the mechanism of crystallisation of water still remains an open and challenging question.

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**NBR: 303972** **ACRONYM: CELLMECH** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** Molecular-Physical Basis of Cell-Biomaterial Mechanical Coupling

**Abstract:** I seek to understand the molecular origin of cell mechanosensing - the ability of biological cells to sense and respond to the mechanical properties of their environment. Moreover, I want to explore the possibility that propagation of mechanical deformation within soft biomaterials can act as a communication route between neighboring cells. A long term goal is to guide injured axons to establish reconnection with the proper target by directing the axon towards the mechanical deformations generated by the target cell. ‘Cell mechanosensing’ raises some basic science questions, part of which can only be solved by an interdisciplinary-multi-scale approach, combining concepts from macroscopic approaches - such as elasticity theory and rheology - with a molecular point of view, taking into account the intricate interplay of chemical and physical processes.

We will use a unique combination of high resolution optical microscopy, single molecule imaging, magnetic tweezers, biomaterial design and characterization, numerical algorithms and theoretical modeling. In particular, our aims include: 1. Characterization of the force generated by neuronal growth cone and its frequency, before and following injury. 2.Developing new engineered protein biomaterials with mechano-sensitive properties and a well defined dynamic viscoelastic profile which are able to support neuronal cell growth. These include biomaterials which: a) Change their fluorescence properties in response to small material deformations in the nanometer range. b) Efficiently propagate and amplify growth-cone-generated mechanical deformations to allow for cell-cell communication. An essential part of this project is studying the dependence of the viscoelastic spectrum of the network on the mechanical properties of the single chain. 3. Identifying the feedback mechanism that enables the cell to regulate its intrinsic elasticity and the forces it applies in response to the mechanical properties of the substrate.

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**NBR: 304043** **ACRONYM: THERMO-SPINTRONIC** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** High Performance Energy Conversion by the interplay between Thermoelectricity and Spin Seebeck Effect

**Abstract:** In view of the global energy and environmental demand, the necessity to use the energy sources more efficiently becomes relevant. Since most of energy is still being lost into the environment as waste heat, significant amount of renewable energy remains unused. In this context, thermoelectric materials, which can generate electricity from waste heat, could play an important role in a sustainable energy solution optimizing its consumption. However, the application of thermoelectric generation based classical Seebeck effect is limited to specific cases due to efficiency problems. The control and re-use of heat are therefore important topics in thermoelectricity as well as for the development of spin-based electronics, called spintronics. A recent discovery of spin-Seebeck effect (SSE), reported as a measurement of a redistribution of spins along the sample or “spin voltage” induced by a temperature gradient, generated strong interest in the research community. The existence of this novel effect was recently demonstrated in metallic ferromagnets, diluted magnetic semiconductors and even in oxide insulators. This work aims to obtain a more efficient heat-to-electricity conversion by the combination of these two properties: the classical Seebeck effect and Spin-Seebeck effect being pioneer in applying this concept. To study the interplay between these two effects, suitable binary oxides and perovskite system will be fabricated in insulator/metal hybrid systems (oxides/ferromagnets) and in high-quality superlattices and/or nanoparticles. The insulator will provide the low thermal conductivity which enables to suppress the energy loss due to heat conduction and the SSE could augment the thermoelectric generation efficiency. For this project, modern synthesis methods

and state-of-the-art characterization will be employed. The results will highlight the engineering of heat transport in spintronic devices and facilitate the functional use of heat.

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**NBR: 304150** **ACRONYM: BUNSMAT** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** Microstructural Design of Bulk Ultra-fine Grained and Nanostructured Materials for High Performance Applications

**Abstract:** Bulk ultra-fine grained (UFG) and nanostructured (NS) materials have attracted immense interest in recent years due to the paramount goal of achieving simultaneous increase in strength and ductility. A unique method for obtaining these materials is the utilization of severe plastic deformation for structural refinement. Despite their technological importance in industries ranging from automotive and aerospace to energy and biomedical; efforts on difficult-to-work hexagonal close packed (hcp) materials have been comparably limited in quantity and scope. Robust utilization of UFG-NS materials in engineering applications will not be possible without exploring the mechanical behavior within given operation envelopes, typically not limited to ambient or monotonic conditions. This project aims to investigate the monotonic-cyclic response of severely deformed hcp materials by exhibiting the interplay of unique deformation mechanisms at the micro-nano scale, and strengthen the understanding of their effects on the observed mechanical behavior. With the aid of novel characterization techniques, trends in the processing-structure-property relations among the model materials will be demonstrated. These will be incorporated in physically sound constitutive models for improving the predictive capabilities. Ultimately, these efforts will fill in the crucial missing gap between engineered microstructures and envisaged applications for European competitiveness and welfare. Over the last decade, the PI has experienced with multiple projects in quest for fabricating, characterizing and modeling high performance advanced materials. The current proposal facilitates bringing this expertise on the processing intricacies, characterization techniques, plasticity modeling and applications of severely deformed materials to the dynamic ERA. In this endeavor, the availability of the CIG will be of vital importance, providing seamless knowledge transfer and sustainability of research efforts.

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**NBR: 304167** **ACRONYM: SILICONSPIN** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** Spin Transport in Silicon Nanodevices

**Abstract:** Spintronics is the vision of using the spin of the electrons instead of its charge to perform information storage and processing. These spin based devices has the potential to make the future computers non-volatile, faster, with memory and processing integrated into a single chip, all with reduced energy consumption. A profound impact on the development of spintronics could come from exploiting spin degree of freedom in the main stream semiconductor like silicon at room temperature. The first goal of this proposal is to establish a physical understanding of the fundamental processes of efficient generation, sensitive detection, and effective manipulatipon of spin current in silicon. Spin polarization in silicon will be created by different methods such as - electrical spin injection, thermal spin injection, spin pumping, and spin Hall effect using ferromagnet/silicon heterostructures. Detection of the created spin polarization will be performed by combination of different techniques both in local and non-local geometry, for example by use of spin-valve measurements, Hanle measurements and inverse spin Hall effect measurements. Finally the manipulation of such spin polarization will be controlled by magnetic field and electric field. The aim of this proposal is to achieve all these operations in both n-type and p-type silicon at room temperature. The second goal is to implement silicon spintronic devices by integrating different functionalities obtained from our first goal. While relevant for the development of a spin based transistor, this work aims to go well beyond that, aiming for new routes to create and control spins in silicon nanostructures. For realization of this we propose to develop novel approaches for fabrication of silicon based nano-spintronic devices and design new transport measurement techniques which will lead to these fundamental physics experiments, and possibly new applications.

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**NBR: 304179** **ACRONYM: UDENOP** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** Ultrafast Dynamics, Energy Exchanges, and Non-linear Optical Properties of Resonant Nanostructures

**Abstract:** After a decade of existence, and driven by a remarkable expansion in research and development, plasmonics –the technology that exploit the unique optical properties of metallic nanostructures to enable routing and active manipulation of light at the nanoscale- has entered a defining period in which researchers will seek to answer a critical question: can plasmonics provide a viable technological platform which includes both passive and active nanodevices? The design of these devices is driven by a two-fold objective: 1) to manipulate electromagnetic energy at the nanoscale, including harvesting, guiding and transferring energy, with high lateral confinement down to a few tens of nanometers, and 2) to generate ultrafast and strong non-linear effects with low operating powers to produce basic active functions such as transistor or lasing actions.

Utilizing the resonant properties –field enhancement and spectral sensitivity- of Surface Plasmons Polaritons (SPPs) is generally thought to represent a practical avenue to achieving this objective. In this context, this research aims to assess the potential for defects to enhance the non-linear optical properties of plasmonic crystals. The objective is to integrate defects, made of plasmonic cavities, in plasmonic crystals to create a focal point for electromagnetic energy stored in surface plasmon waves at the crystal's interfaces. The role of the defect is then to transfer this energy to a neighbouring non-linear material in order to change its optical properties at the femtosecond timescale, thus creating an active functionality. This research, largely based on ultrafast time-resolved near-field optical microscopy, is also expected to enhance our understanding of ultrafast energy transfers at the nanoscale- a critical expertise in designing nanodevices.

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**NBR: 304193** **ACRONYM: NANOCOORD** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** Design, study and development of novel functional hybrid nanomaterials, which consist of a nanoparticle core and an unconventional shell of coordination entities with synergetic properties.

**Abstract:** In many strategic research areas, particularly in electronics and medicine, nanochemistry-based technologies have recently grown considerably owing to the specific properties of the nanoscale (e.g. room temperature superparamagnetism, quantum effects), which are hardly accessible by traditional chemical approaches. In this context, most of the actual research carried out on nanomaterials is looking at functionalizing the surface of nano-objects with selective organic / bioorganic entities to implement and tailor the resulting properties and applied perspectives. In contrast, the consideration of coordination entities, such as transition-metal complexes, on the surface of nano-objects is hitherto rather limited and remains to be investigated in a systematic way. The NANOCOORD project is tackling this purpose with a distinct and unexplored approach of associating coordination entities (CE) to the outer surface of inorganic nanoparticles (NP). Therefore, the proposed strategy is paving the way to specific and remarkable properties such as magnetic bistability or photo-dynamic therapy while enlarging the applications panel. The particular knowledge gap in this research area legitimates the development of the project that visions to exploit the distinctive attributes of nanochemistry and coordination chemistry to design innovative functional materials with complementary properties. In light of the numerous potential applications, it is crucial to stress that this multidisciplinary project does not claim to cover all the possibilities but aims at a more methodical exploration of such NP@CE heterostructures, via a judicious and initially restricted selection of two application fields of high impact: combination therapy and data storage. The potential outcomes are highly relevant from both a fundamental scientific and technological perspective.

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**NBR: 304209** **ACRONYM: HEART PATCH** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** Development of a Bioengineered Heart Patch for the Treatment of Myocardial Infarction.

**Abstract:** Background: Cardiovascular diseases (CVD), e.g. Myocardial Infarction (MI) and stroke, are the leading cause of death, accounting each year for more than 17.5 million people worldwide, 25% of which is in Europe. Cardiac bioengineering is a new research area to develop grafts and patches to replace or repair damaged heart tissue. However, a fully functional graft has not yet conceived. The main goal of this project is to develop bioengineered heart patches to induce regeneration of the tissue and restore heart functions after MI. Aims: the aims and the results hoped for are: 1. To develop collagen-based nano-fibrous scaffolds that are: a. Biocompatible and biodegradable, e.g. favour cell growth, and allow regeneration of the host tissue and remodel with the growing heart. b. Robust, elastic, and contractile that matches heart muscle. c. Conductive to electrical impulses generated by the heart. d. Porous enough to enable exchange of nutrients and waste from the patch. e. Non-thrombogenic to ensure the patch will not cause thrombosis. 2. To significantly reinforce the biomedical research in Europe through efficient use of the allocated budget toward my integration into a more permanent position in Sweden, as well as enhancing knowledge transfer and cooperation between EU and Canada. Research Strategy: I have previously developed hybrid interpenetrating polymer networks (HIPN) as bioengineered corneas that were mimetic of the natural cornea and successfully implanted into corneas of pigs with seamless host-graft integration and regeneration of the host cornea. HIPN is a core concept that can be tailored for various tissue applications. I therefore propose to engineer HIPN scaffolds for cardiac patches mainly comprised of collagen, and carbon nanotubes. I joined Linkoping University in March 2011 as an Assistant Professor from Canada. My expertise in tissue engineering combined with expertise of the host in Nanobiotechnology is an excellent match for this project.

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**NBR: 304249** **ACRONYM: CQ3D** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2011-CIG** **Thema:** FP7-PEOPLE-2011-CIG

**Title:** 3D Circuit Quantum Electrodynamincs with Flux Qubits

**Abstract:** cQ3D proposes a 48-month program to improve the quantum coherence of superconducting flux qubits using cutting-edge developments in circuit quantum

electrodynamics (QED). Beyond the immediate benefit to quantum computing with superconducting circuits, this effort will enable fundamental physics, such as the investigation of non-equilibrium quasiparticles in superconductors. Finally, it will pave the way for hybrid quantum computing with superconducting flux qubits coupled to electronic spins. cQ3D will first focus on achieving strong coupling of flux qubits to three-dimensional (3D) superconducting resonators. The evolution from 2D to 3D circuit QED reduces the contribution of lossy metal and dielectric surfaces and interfaces to qubit energy decay by storing this energy primarily in vacuum. By providing a means to control, couple and measure flux qubits in a near-perfect electromagnetic environment with minimal additional circuitry, we aim to surpass and elucidate current limits to coherence in flux qubits. In particular, this pursuit may uncover a contribution from non-thermal distributions of quasiparticles, as predicted by recent theory. The developed architecture will finally be used to couple small ensembles of electronic spins to flux qubits and/or to resonators using flux qubits as a quantum interconnect. A CIG grant will facilitate the local and international integration of my new group at TU Delft by creating opportunities for collaboration and discussion with several faculty in the Kavli Institute of Nanoscience, and facilitating research complementing that of my international collaborators. Simultaneously, this grant will enable key infrastructure developments in fabrication and simulation that will impact my group beyond the tenure-track race.

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**NBR: 304842** **ACRONYM: NANOBIO4TRANS** **EC FUND: 5968093**

**DG:** RTD **Call: FP7-HEALTH-2012-INNOVATION-2** **Thema:** HEALTH.2012.1.4-2

**Title:** A new nanotechnology-based paradigm for engineering vascularised liver tissue for transplantation

**Abstract:** Organ transplantation is often the only life saving medical approach for several diseases, in spite of many associated problems (lack of organ donors, rejection, life-long heavy medication). The innovative therapeutic approach of the 21th century is focusing on bioartificial organs as an alternative solution.Tissue engineering and stem cell biology have uncovered groundbreaking opportunities for cellular re-programming, i.e., some cell types can be changed into a pluripotent stem cell (PSC) by over-expressing key transcription factors. These induced pluripotent stem cells (iPSC) share two key characteristics with embryonic stem cells (eSC): self-renewal and pluripotency (ability to differentiate to form any cell type in the human body). Crucially, they are generated from adult cells circumventing many ethical concerns associated with using human eSC. The discovery of human iPSC (hiPSC) enables the growth of an almost unlimited supply of a patient´s own cells, potentially conferring the ability to grow and regenerate tissues and organs from 'self', which is expected to resolve organ rejection-related issues. Similarly, recent developments in material science and nanobiotechnology resulted in engineered materials and devices (manipulated and controlled by physical and chemical means), with unique functional or analytical properties. NanoBio4Trans will merge

hiPSC-, polymer hybrid scaffolds and biosensor technologies to develop new tools (beyond state-of-the-art) for use in transplantation and biomedical research. The international, trans-sectoral, and multidisciplinary consortium with complementary and leading expertise in material sciences, cell- and molecular biology, sensor technologies, and bioanalytics, aims at developing, optimising and validating a highly vascularised in vivo-like BAL as an extracorporeal bioartificial liver (EBAL), ready to be perfused with human blood plasma, and to be exploited in modern medical technology.

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**NBR: 304948** **ACRONYM: NANOMAL** **EC FUND: 3992150**

**DG:** RTD **Call: FP7-HEALTH-2012-INNOVATION-2** **Thema:** HEALTH.2012.2.3.0-1

**Title:** Development of a handheld antimalarial drug resistance diagnostic device using nanowire technology

**Abstract:** Malaria is a global health priority that has been targeted for elimination in recent years. Attaining the goals that define elimination of malaria in different countries depends critically on provision of effective antimalarials and further that these antimalarials are used appropriately in individual patients. Drug resistance is a major threat to malaria control and has important global public health implications. Over the past decades the genetic bases for resistance to most of the antimalarial classes currently in use has become defined. For some drugs and combinations, these mutations are the most important predictors of treatment failure. This proposal will innovate new technologies to confirm malaria diagnosis and detect drug resistance in malaria parasites by analysis of mutations in nucleic acids, using nanowire technology, and will result in the development of a simple, rapid and affordable point-of-care handheld diagnostic device. The device will be useful at many levels in malarial control by: 1. Optimising individual treatments for patients 2. Assessing the epidemiology of drug resistance in malaria endemic areas 3. Assessing population impacts of antimalarial interventions The development programme capitalises on highly original and proprietary advances made by QuantuMDx in the field of point-of-care diagnostics. This is complemented by academic expertise that has made major contributions to the understanding of antimalarial drug resistance mechanisms in laboratory models, as well as parasites obtained directly from patients. The impact of this proposal can be extended rapidly to other established and emerging infectious diseases.

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**NBR: 304980** **ACRONYM: 2D–SYNETRA** **EC FUND: 1497200**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE4

**Title:** Two-dimensional colloidal nanostructures - Synthesis and electrical transport

**Abstract:** We propose to develop truly two-dimensional continuous materials and two-dimensional monolayer films composed of individual nanocrystals by the comparatively fast, inexpensive, and scalable colloidal synthesis method. The materials' properties will be studied in detail, especially regarding their (photo-) electrical transport. This will allow developing new types of device structures, such as Coulomb blockade and field enhancement based transistors. Recently, we demonstrated the possibility to synthesize in a controlled manner truly two-dimensional colloidal nanostructures. We will investigate their formation mechanism, synthesize further materials as "nanosheets", develop methodologies to tune their geometrical properties, and study their (photo-) electrical properties. Furthermore, we will use the Langmuir-Blodgett method to deposit highly ordered monolayers of monodisperse nanoparticles. Such structures show interesting transport properties governed by Coulomb blockade effects known from individual nanoparticles. This leads to semiconductor-like behavior in metal nanoparticle films. The understanding of the electric transport in such "multi-tunnel devices" is still very limited. Thus, we will investigate this concept in detail and take it to its limits. Beside improvement of quality and exchange of material we will tune the nanoparticles' size and shape in order to gain a deeper understanding of the electrical properties of supercrystallographic assemblies. Furthermore, we will develop device concepts for diode and transistor structures which take into account the novel properties of the low-dimensional assemblies. Nanosheets and monolayers of nanoparticles truly follow the principle of building devices by the bottom-up approach and allow electric transport measurements in a 2D regime. Highly ordered nanomaterial systems possess easy and reliably to manipulate electronic properties what make them interesting for future (inexpensive) electronic devices.

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**NBR: 305003** **ACRONYM: QUANTUMSUBCYCLE** **EC FUND: 1494564**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE3

**Title:** Ultrafast quantum physics on the sub-cycle time scale

**Abstract:** The physics of condensed matter depends on ultrafast dynamics of its atomic constituents. Femtosecond light pulses have been exploited to monitor these phenomena by stroboscopic means. Yet, the time resolution is limited by the duration of the intensity envelope of the light pulses used. We propose a new class of sub-cycle optics, which harnesses the absolute optical phase and amplitude of ultrashort transients to control condensed matter faster than an oscillation cycle of light. Merging latest terahertz technology with nanooptics, we tailor extreme electric and magnetic near-fields of phase-locked infrared pulses in all four spatio-temporal dimensions. This unprecedented laboratory allows us to pioneer long sought-after non-adiabatic quantum physics of all relevant elementary degrees of freedom: electronic charge and

spin as well as photons. (i) Optical acceleration of electrons in the sub-cycle limit will permit to test yet unobserved key concepts of relativistic quantum transport, such as Zitterbewegung of Dirac fermions and Bloch oscillations in bulk semiconductors. (ii) We aim to switch the spin direction in magnetic materials by giant magnetic or electric fields, of 10 GV/m and several 10 Tesla, promising record control speeds and unique vistas onto the fastest magnetic elementary processes. (iii) By advancing the sensitivity of electro-optic sampling to the few-photon level the quantum nature of the oscillating carrier wave will be detected in the time domain. Spontaneous creation of photons out of quantum vacua, reminiscent of Hawking radiation of black holes, may be traced. The project breaks grounds for basic research, shedding new light onto the foundations of quantum electrodynamics, solid state physics and magnetism, as well as a new kind of field resolved quantum optics.

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**NBR: 305137** **ACRONYM: HIVINNOV** **EC FUND: 6000000**

**DG:** RTD **Call: FP7-HEALTH-2012-INNOVATION-1** **Thema:** HEALTH.2012.2.3.2-3

**Title:** Generation of a new class of antiretrovirals targeting HIV-cellular cofactors interactions

**Abstract:** Highly active antiretroviral therapy is effective at controlling HIV-1 replication, however emergence and transmission of drug-resistant viruses is increasing, including viruses resistant to the newly developped integrase catalytic inhibitors. It is essential that new antiretrovirals (ARVs) become available. Most ARVs in development belong to the classes of viral enzyme inhibitors. Since HIV requires cellular cofactors for its replication cycle, we aim to develop novel classes of ARVs inhibiting specific virus-host interactions. Because host cell factors mutate rarely, this new class of ARVs should be less vulnerable to resistance. We selected two cellular targets, LEDGF/p75 and Transportin-SR2 (Trn-SR2), cofactors of Integrase (IN) and Capsid (CA) respectively, important for viral integration and nuclear transport. Partners of this consortium, R. Benarous, P. Cherepanov, A. Fassati and S. Emiliani, discovered, with others, these targets and elucidated their structure and function. Partner 1 SME BIODIM (FR), consortium leader, has developped small compound inhibitors of IN-LEDGF interaction. BIODIM compounds have a clear structure activity relationship, nanomolar ARV activity and are based on a new, structurally defined pharmacophore. The objectives of this project are to 1) Advance BIODIM IN-LEDGF inhibitors up to the proof of concept (POC) in man in a phase I/IIa clinical trial with partner 6 J. Gatell (SP) 2) Discover small compounds targeting the Trn-SR2 pathway in HIV-1 infection using a high throughput screening assay validated by partner 2 A. Fassati (UK), determine the pharmacophore by solving the 3D structure of Trn-SR2 with partner 3 P. Cherepanov (UK) and optimize the compounds up to the POC in a humanized mouse model of HIV infection with partner 5, B. Berkhout (NL) 3) Elucidate with partner 4 Emiliani/Saïb (FR) the network of interactions in which Trn-SR2 is involved with CA from uncoating to the pre-integration complex to provide new ARV drug targets.

**NBR: 305152** **ACRONYM: NANOMED2020** **EC FUND: 499647**

**DG:** RTD **Call: FP7-HEALTH-2012-INNOVATION-1** **Thema:** HEALTH.2012.4.1-5

**Title:** Enabling the European Nanomedicine Area until 2020

**Abstract:** Nanotechnology applied to medical applications, Nanomedicine, is one of the most important emerging areas of health research and is understood to be the most promising out of the six KETs, for innovative devices and materials for personalised, targeted and regenerative medicine. However, due to the complexity of technologies and medical application areas Nanomedicine requires many different so far independent stakeholders from academia, industry and regulatory bodies. Due to the diversity of stakeholders the partners of this project will initiate a strong coordination and support action to build a pertinent European Nanomedicine community involving all key players necessary to define the resources, gaps and needs for development and implementation of nanomedical research into marketable innovations to be used by doctors for the benefit of patients. The implementation concepts will also target the initiation of Public Private Partnerships for the creation of novel infrastructures and innovative funding programmes. Nanomedicine research is growing fast in many countries. Therefore, the project consortium will initiate international collaborations in the Nanomedicine area, especially the coordination of international regulation of Nanomedicine products. The partners involved in the project represent major European networks combining academia, industry, clinicians and public authorities. Based on this strong partnership and after integration of further national and European initiatives the output of this support action will be a strong, established partnership of relevant stakeholders in identified key areas of Nanomedicine with new concepts for translation of nanomedical innovations into clinical practice and efficient and transparent communication channels. This will make Nanomedicine an important contributor to the future European healthcare system with a beneficial impact on improved treatment for patients and on social challenges such as ageing population.

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**NBR: 305305** **ACRONYM: EE-ASI** **EC FUND: 5983871**

**DG:** RTD **Call: FP7-HEALTH-2012-INNOVATION-1** **Thema:** HEALTH.2012.2.4.3-1

**Title:** Beta cell preservation via antigen-specific immunotherapy in Type 1 Diabetes: Enhanced Epidermal Antigen Delivery Systems.

**Abstract:** Current approaches to improving glycaemic control in type 1 diabetes are centered on increasingly complex insulin delivery systems. However, less than 30% of patients can

achieve target levels of glucose control with this approach even in a clinical trial setting and many patients are either unable or unwilling to make the personal commitment required. By contrast, preservation of even small amounts of endogenous insulin production, has been shown to improve glycaemic control, reduce hypoglycaemia, improve quality of life and reduce long-term complications. Importantly, glycemic control in the presence of endogenous beta cell function is not demanding and hence would be effective across the full spectrum of individuals. Antigen specific immunotherapy (ASI) is the preferred approach to beta cell preservation since this avoids the risks of immunosuppression. Attempts at ASI to date although successful in preclinical models have had limited efficacy in humans. There is therefore an urgent need for the development of novel approaches to deliver effective ASI. Our Enhanced Epidermal – Antigen Specific Immunotherapy (EE-ASI) system represents an innovative approach to ASI created by combining technologies brought by our academic and 2 SME partners. A beta cell target T cell epitope (proinsulin C19-A3) will be combined with the tolerogenic cytokine IL-10 and targeted to antigen presenting cells via gold nanoparticles and delivery into the very superficial layers of the skin using microneedles. Validation of manufacture, in vitro and in vivo preclinical efficacy will be demonstrated followed by a phase 1 clinical trial to confirm safety in humans. We anticipate that the EE-ASI system will be less costly, more effective and more acceptable to patients in improving glycaemic control than exogenous insulin replacement. Intellectual property, regulatory and ethical issues will be carefully addressed in order to maximise exploitation of this integrated system for the benefit of the SMEs.

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**NBR: 305736** **ACRONYM: REDDSTAR** **EC FUND: 5894387**

**DG:** RTD **Call: FP7-HEALTH-2012-INNOVATION-1** **Thema:** HEALTH.2012.2.4.3-1

**Title:** Repair of Diabetic Damage by Stromal Cell Administration

**Abstract:** 50 million diabetic EU citizens are using approved anti-diabetic agents to control their glycaemia. However, suboptimal glycemic control leads to 6 progressive diabetic complications, namely: nephropathy, retinopathy, cardiomyopathy, neuropathy and foot ulceration. In 2010, 11% of EU adult deaths (634,000) were caused by diabetic complications. These distinct disorders have few effective medicines and present challenging management issues for clinicians. Stromal Stem Cells (SSC) are a mixed population of plastic-adherent (PA) cells isolated from adult bone marrow. PA-SSC secrete potent immunosuppressive and angiogenic proteins and over 100 clinical trials are testing PA-SSC in 40 distinct autoimmune and ischemic diseases. Notably, preclinical studies show a single intravenous administration of un-modified PA-SSC can control rodent hyperglycaemia, prompting 10 recent clinical safety studies in diabetic patients. REDDSTAR will comprehensively examine if SSC can safely repair all 6 damaged tissues and control glycaemia in three different species. To facilitate this we identified an antibody (S2) that prospectively isolates comparable, equivalent S2+SSC from human,

rat, mouse and rabbit marrow, enabling testing of pure S2+/- SSC and mixed PA-SSC from each species for the first time. Furthermore, separation of PA-SSC into S2+ and S2- fractions reveal functionally distinct populations. REDDSTAR partners have collectively developed five distinct clinically-relevant in vivo models of the 6 key diabetic complications. We will assess if S2+, S2- and PA-SSC exert differing control of glycaemia and tissue repair in each model. Finally, REDDSTAR partners are developing the first benchtop GMP-grade nanosorter, enabling clinical purification of S2+ and S2- SSC for human safety trials. We will dissect how S2+ and S2- SSC simultaneously repair tissue damage and maintain glycaemic control, an effect not observed with any current therapy.

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**NBR: 305937** **ACRONYM: BERENICE** **EC FUND: 2998217**

**DG:** RTD **Call: FP7-HEALTH-2012-INNOVATION-1** **Thema:** HEALTH.2012.2.3.2-4

**Title:** Benznidazol and Triazol REsearch group for Nanomedicine and Innovation on Chagas diseasE

**Abstract:** The BERENICE consortium is aiming at providing a new and cost-effective solution to a better treatment for Chagas chronic patients. Please see its objectives below : Main objective • Obtain a more effective, better tolerated and cheaper formulation of a drug with trypanocidal activity to cure Chagas disease Specific Objectives • Obtain results of pharmacokinetics of new formulations • Assess trypanocidal activity of new formulations in vitro and in animal model • Involve partners, research and industry in endemic countries to promote technology transfer and promote in-site solutions at cheaper cost. The foreseen results of this project would have firstly an impact on the better comprehension and control of the SUVs behavior as drug delivery nanodevices for the specific APIs to be conjugated. If this conjugation is successful, further impacts are expected dealing with technology transfer issues, such as scale-up of the corresponding SUVs preparation methodology and its implementation at industrial scale. Apart from including stong participation from endemic countries's institutions, the consortium also involves private companies, thus enabling the participation of all the key actors of the chain to confront and control better Chagas disease. The innovative approach, through the new developed nano- and microparticles based formulations will have an important impact on the safety of the medicament since the therapeutic efficacy will increase and consequently the doses needed and the incidences caused by adverse effects will be reduced.

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**NBR: 306292** **ACRONYM: NONEQ.STEEL** **EC FUND: 1482011**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE8

**Title:** Controlling Non-Equilibrium in Steels

**Abstract:** Stronger and more ductile steels are increasingly demanded for advanced applications. Latest investigations show that nanostructured steels formed by non-equilibrium phases increasing strength, such as martensite and bainite, and enhancing strain hardening, such as austenite, fulfil these demands with outstanding performance. In the last few years, I have observed that non-equilibrium phases strongly affect each other's formation and stability, with effects on the kinetics of the microstructure development. Thus, I theoretically and experimentally proved that carbon enrichment of austenite, essential for its stability at room temperature, occurs at a high rate via diffusion from martensite. Moreover, I showed that martensite triggers bainite formation, which significantly increases bainite kinetics. I believe that these interactions between non-equilibrium phases constitute a revolutionary tool for the development of nanostructured steels in the future. This project addresses a new concept to create novel nanostructured steels in which the microstructure development is controlled by interactions between non-equilibrium phases. This innovative idea opens an unprecedented approach for the design of metallic alloys. Since interactions between phases affect each other's formation and stability, the project focus on the fundamental study of nucleation and growth of non-equilibrium phases as well as on the analysis of interactions. Investigations will combine the integrated application of advanced experimental techniques with atomic and micro scale analysis of structures by simulations. The project continues with the local analysis of the effect of non-equilibrium phases on the mechanical properties of the steels. The identification and explanations of mechanisms will allow the creation of new nanostructured steels based on non-equilibrium phases' interactions.

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**NBR: 306298** **ACRONYM: EN-LUMINATE** **EC FUND: 1496684**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE4

**Title:** Enhancing and Tuning Electroluminescence with Nanoantennas

**Abstract:** Being able to enhance and tune the interaction of a light wave with a molecule or nanoparticle on a fundamental level opens up an exciting range of applications such as more efficient solar cells, more sensitive photon detectors and brighter emitters for lighting applications. Nanoplasmonics promises to offer this level of control. Taking the current knowledge on nanoantennas a step further we will integrate them in organic and carbon-nanotube light-emitting devices to improve and tune their emission in unprecedented ways. As our testing platform we will use light-emitting field-effect transistors (LEFETs). Their planar structure, where the light emission zone can be positioned at any point allows for easy and controlled incorporation of plasmonic

structures without interfering with charge transport. LEFETs can be made from a wide range of semiconducting materials. We will apply nanoantennas in LEFETs to 1) Enhance electroluminescence of high mobility organic semiconductors 2) Tune excitation decay and transition selection rules in organic semiconductors and 3) Enhance photo- and electroluminescence of single-walled carbon nanotubes. All of these materials offer high carrier mobilities and therefore high currents but have very low fluorescence efficiencies that can be improved substantially by nanoantennas. We will study the influence of nanoantennas on the fundamental emission properties of these different types of emitters. At the same time we will improve their efficiency in light-emitting devices and thus enable new and innovative applications.

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**NBR: 306357** **ACRONYM: NANO-JETS** **EC FUND: 1491823**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE8

**Title:** Next-generation polymer nanofibers: from electrified jets to hybrid optoelectronics

**Abstract:** This project ultimately targets the application of polymer nanofibers in new, cavity-free lasers. To this aim, it wants to tackle the still unsolved problems of the process of electrospinning in terms of product control by the parameters affecting the dynamics of electrified jets. The electrospinning is based on the uniaxial elongation of polymeric jets with sufficient molecular entanglements, in presence of an intense electric field. It is a unique approach to produce nanofibers with high throughput. However, the process is still largely suboptimal, the most of nanofiber production being still carried out on an empirical basis. Though operationally simple, electrospinning is indeed complex as the behavior of electrified jets depends on many experimental variables making fully predictive approaches still missing. This project aims to elucidating and engineering the still unclear working principles of electrospinning by solutions incorporating active materials, with a tight synergy among modeling, fast-imaging characterization of electrified jets, and process engineering. Once optimized, nanofibers will offer an effective, well-controllable and cheap material for building new, cavity-free random laser systems. These architectures will enable enhanced miniaturization and portability, and enormously reduced realization costs. Electrospun nanofibers will offer a unique combination of optical properties, tuneable topography and light scattering effectiveness, thus being an exceptional bench tool to realize such new low-cost lasers, which is the second project goal. The accomplishment of these ambitious but well-defined objectives will have a groundbreaking, interdisciplinary impact, from materials science to physics of fluid jets in strong elongational conditions, from process to device engineering. The project will set-up a new, internationally-leading laboratory on polymer processing, making a decisive contribution to the establishment of scientific independence.

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**NBR: 306387** **ACRONYM: PICSEN** **EC FUND: 1499708**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE3

**Title:** Propagative and Internal Coherence in Semiconductor Nanostructures

**Abstract:** This project concerns the field of coherent, nonlinear, ultrafast light-matter interaction on a quantum level in solids. It proposes to experimentally explore limits of: i) internal coherence of an individual emitter; ii) radiative coupling between pairs of emitters. A potential long term application of this work could be envisaged, as one can expect that individual emitters could serve as qubits for implementations of optically controlled quantum information processing in solids. As individual emitters we will employ excitons in semiconductors: either bound to impurities or confined in quantum dots. Firstly, by embedding the latter into upright photonic nanowires, that are now available in the team, we will amplify the collection of their coherent optical response by nearly four orders of magnitude as compared to the current state-of-art. This will provide an unprecedented access to their coherent as well as dephasing interaction with phonons. It will also enable retrieval of their n-wave mixing responses to scrutinize coherent couplings within an individual emitter. The second objective is the demonstration of an efficient, controllable and non-local coherent coupling mechanism between distant emitters, which is a prerequisite for the construction of quantum logic gates and networks. Here, such a radiative coupling will be demonstrated and manipulated using resonant emitters embedded into in-plane one-dimensional waveguides, which permit virtually unattenuated propagation of coherence. The internal and propagative coherence of individuals and radiatively coupled pairs will be explored using beyond-the-state-of-the-art methods of coherent nonlinear spectroscopy. Specifically, we will develop a spatially-resolved heterodyne spectral interferometry combined with ultrafast pulse-shaping. The proposed advanced methodology of this ERC project can be associated with techniques developed in other domains, like nuclear magnetic resonance and astrophysics instrumentation.

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**NBR: 306435** **ACRONYM: JELLY** **EC FUND: 1497166**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE4

**Title:** Biomolecular Hydrogels â€“ from Supramolecular Organization and Dynamics to Biological Function

**Abstract:** Certain proteins and glycans self-organize in vivo into soft and strongly hydrated, dynamic and gel-like supramolecular assemblies. Among such biomolecular hydrogels are the jelly-like matrix that is formed around the egg during ovulation, mucosal membranes, slimy coats produced by bacteria in biofilms, and the nuclear pore

permeability barrier. Even though biomolecular hydrogels play crucial roles in many fundamental biological processes, there is still a very limited understanding about how they function. Our goal is to assess and to understand the relation between the organizational and dynamic features of such supramolecular assemblies, their physicochemical properties, and the resulting biological functions. We will investigate these relationships directly on the supramolecular level, a level that - for this type of assemblies - is hardly accessible with conventional approaches. To this end, we use purpose-designed in vitro model systems that are well-defined in the sense that their composition and supramolecular structure can be controlled and interrogated. These tailor-made models, together with a toolbox of surface-sensitive in situ analysis techniques, permit tightly controlled and quantitative experiments. Combined with polymer physics theory, the experimental data allow us to directly test existing hypotheses and to formulate new hypotheses that can be further tested in complementary molecular and cell-based assays. This project focuses on two types of biomolecular hydrogels: (i) the nuclear pore permeability barrier, a nanoscopic protein meshwork that regulates all macromolecular transport into and out of the nucleus of eukaryotic cells, and (ii) extracellular hydrogel-like matrices that are scaffolded by the polysaccharide hyaluronan and that are of prime importance in a wide range of physiological and pathological processes including inflammation, fertilization and osteoarthritis.

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**NBR: 306447** **ACRONYM: ABINITIODGA** **EC FUND: 1491090**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE3

**Title:** Ab initio Dynamical Vertex Approximation

**Abstract:** Some of the most fascinating physical phenomena are experimentally observed in strongly correlated electron systems and, on the theoretical side, only poorly understood hitherto. The aim of the ERC project AbinitioDGA is the development, implementation and application of a new, 21th century method for the ab initio calculation of materials with such strong electronic correlations. AbinitioDGA includes strong electronic correlations on all time and length scales and hence is a big step beyond the state-of-the-art methods, such as the local density approximation, dynamical mean field theory, and the GW approach (Green function G times screened interaction W). It has the potential for an extraordinary high impact not only in the field of computational materials science but also for a better understanding of quantum critical heavy fermion systems, high-temperature superconductors, and transport through nano- and heterostructures. These four physical problems and related materials will be studied within the ERC project, besides the methodological development. On the technical side, AbinitioDGA realizes Hedin's idea to include vertex corrections beyond the GW approximation. All vertex corrections which can be traced back to a fully irreducible local vertex and the bare non-local Coulomb interaction are included. This

way, AbinitioDGA does not only contain the GW physics of screened exchange and the strong local correlations of dynamical mean field theory but also non-local correlations beyond on all length scales. Through the latter, AbinitioDGA can prospectively describe phenomena such as quantum criticality, spin-fluctuation mediated superconductivity, and weak localization corrections to the conductivity. Nonetheless, the computational effort is still manageable even for realistic materials calculations, making the considerable effort to implement AbinitioDGA worthwhile.

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**NBR: 306475** **ACRONYM: BIOTORQUE** **EC FUND: 1500000**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE3

**Title:** Probing the angular dynamics of biological systems with the optical torque wrench

**Abstract:** The ability to apply forces to single molecules and bio-polymers has fundamentally changed the way we can interact with and understand biological systems. Yet, for many cellular mechanisms, it is rather the torque that is the relevant physical parameter. Excitingly, novel single-molecule techniques that utilize this parameter are now poised to contribute to novel discoveries. Here, I will study the angular dynamical behavior and response to external torque of biological systems at the molecular and cellular levels using the new optical torque wrench that I recently developed. In a first research line, I will unravel the angular dynamics of the e.coli flagellar motor, a complex and powerful rotary nano-motor that rotates the flagellum in order to propel the bacterium forwards. I will quantitatively study different aspects of torque generation of the motor, aiming to connect evolutionary, dynamical, and structural principles. In a second research line, I will develop an in-vivo manipulation technique based on the transfer of optical torque and force onto novel nano-fabricated particles. This new scanning method will allow me to map physical properties such as the local viscosity inside living cells and the spatial organization and topography of internal membranes, thereby expanding the capabilities of existing techniques towards in-vivo and ultra-low force scanning imaging. This project is founded on a multidisciplinary approach in which fundamental optics, novel nanoparticle fabrication, and molecular and cellular biology are integrated. It has the potential to answer biophysical questions that have challenged the field for over two decades and to impact fields ranging from single-molecule biophysics to scanning-probe microscopy and nanorheology, provided ERC funding is granted.

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**NBR: 306535** **ACRONYM: HOLOVIEW** **EC FUND: 1500000**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE7

**Title:** Single active dopant detection in semiconductor nanowires using electron holography.

**Abstract:** The end of "happy scaling" in the semiconductor industry has lead to innovation being a key parameter in nanoelectronics. Doped nanowires of all types of sizes, shapes and composition are now used as components to build nano-electronic devices, light sources, detectors and for photovoltaic applications. As these devices are reduced in size, the location of individual dopant atoms becomes more important and the behavior of only one or two atoms can dominate their properties. More recently, research into devices that contain a single dopant atom has begun to gain momentum. At this time there is no method that can routinely measure the presence of the single dopant atoms that are inside these devices and our experience in the nanotechnology age has taught us that we cannot make what we cannot see. In 2011, several review papers in high-impact journals have highlighted the need for a technique that can see these atoms. Their detection is now within reach, using a technique known as off-axis electron holography.

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**NBR: 306664** **ACRONYM: GANOMS** **EC FUND: 1495800**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE3

**Title:** GaAs Nano-OptoMechanical Systems

**Abstract:** A Nano-OptoMechanical System (NOMS) is an ideal interface between nanomechanical motion and photons. The merits of such a system depend crucially on the level of optical/mechanical coupling. For sufficient coupling, the nanomechanical motion is efficiently imprinted on photons and read-out with the assets of optical detection: broadband, fast, ultra sensitive (ultimately quantum limited). Moreover, in a NOMS, the very dynamics of the motion (its frequency, damping, noise spectrum) can be controlled by optical forces. This opens novel roads for nanomechanical sensing experiments, both classical or quantum, that need now to be experimentally investigated and brought in compliance with future on-chip applications. This project relies on Gallium-Arsenide (GaAs) disk optomechanical resonators, where photons are stored in high quality factor optical whispering gallery cavities and interact with high frequency (GHz) nanomechanical modes. We have recently shown that these resonators possess a record level of optomechanical coupling and are compatible with on-chip optical integration. The first aim of the project is to investigate in depth the mechanisms leading to optical and mechanical dissipation in GaAs nanoresonators, and obtain GaAs NOMS with ultra-low dissipation. The second aim is to realize prototype nano-optomechanical force measurements with a GaAs disk resonator set in optomechanical self-oscillation, to establish the potential of this novel approach for sensing. This will be done both under vacuum and in a liquid. The behavior of two NOMS integrated on the same chip will also be studied, as first archetype of parallel architectures. A third aim is to operate GaAs NOMS at their quantum limit, using cryogenics, optomechanical cooling and novel

concepts where an active optical material like a Quantum dot or Quantum well is inserted in the GaAs NOMS to enhance optomechanical interactions. Transfer of quantum states within a QD-NOMS coupled system will be explored.

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**NBR: 306682** **ACRONYM: SPINAM** **EC FUND: 1352774**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE8

**Title:** Electrospinning: a method to elaborate membrane-electrode assemblies for fuel cells

**Abstract:** This project leads to the development of novel MEAs comprising components elaborated by the electrospinning technique. Proton exchange membranes will be elaborated from electrospun ionomer fibres and characterised. In the first stages of the work, we will use commercial perfluorosulfonic acid polymers, but later we will extend the study to specific partially fluorinated ionomers developed within th project, as well as to sulfonated polyaromatic ionomers. Fuel cell electrodes will be prepared using conducting fibres prepared by electrospinning as supports. Initially we will focus on carbon nanofibres, and then on modified carbon support materials (heteroatom functionalisation, oriented carbons) and finally on metal oxides and carbides. The resultant nanofibres will serve as support for the deposition of metal catalyst particles (Pt, Pt/Co, Pt/Ru). Conventional impregnation routes and also a novel “one pot” method will be used. Detailed (structural, morphological, electrical, electrochemical) characterisation of the electrodes will be carried out in collaboration between partners. The membranes and electrodes developed will be assembled into MEAs using CCM (catalyst coated membrane) and GDE (gas diffusion electrode) approaches and also an original "membrane coated GDE" method based on electrospinning. Finally the obtained MEAs will be characterised in situ in an operating fuel cell fed with hydrogen or methanol and the results compared with those of conventional MEAs.

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**NBR: 306707** **ACRONYM: FUNMANIA** **EC FUND: 1499560**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE7

**Title:** Functional nano Materials for Neuronal Interfacing Applications

**Abstract:** Recent advances in nano technologies provide an exciting new tool-box best suited for stimulating and monitoring neurons at a very high accuracy and with improved bio-compatibility. In this project we propose the development of an innovative nano-material based platform to interface with neurons in-vivo, with unprecedented resolution. In particular we aim to form the building blocks for future sight restoration devices. By doing so we will address one of the most challenging and important

applications in the realm of in-vivo neuronal stimulation: high-acuity artificial retina. Existing technologies in the field of artificial retinas offer only very limited acuity and a radically new approach is needed to make the needed leap to achieve high-resolution stimulation. In this project we propose the development of flexible, electrically conducting, optically addressable and vertically aligned carbon nanotube based electrodes as a novel platform for targeting neurons at high fidelity. The morphology and density of the aligned tubes will mimic that of the retina photo-receptors to achieve record-high resolution. The most challenging element of the project is the transduction from an optical signal to electrical activations at high resolution placing this effort at the forefront of nano-science and nano-technology research. To deal with this difficult challenge, vertically aligned carbon nanotubes will be conjugated with additional engineered materials, such as conducting polymers and quantum dots to build a supreme platform allowing unprecedented resolution and bio-compatibility. Ultimately, in this project we will focus on devising materials and processes that will become the building blocks of future devices so high density retinal implants and consequent sight restoration will become a reality in the conceivable future.

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**NBR: 306719** **ACRONYM: OPTODNPCONTROL** **EC FUND: 1495482**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE3

**Title:** Optically controlled carrier and Nuclear spintronics: towards nano-scale memory and imaging applications

**Abstract:** Carrier spin states in semiconductor nano-structures can be manipulated with fast optical pulses via the optical selection rules. The electron and hole spins in quantum dots interact strongly with the nuclear spins in the host material via the hyperfine interaction. This allows a new, versatile approach to nuclear spintronics, namely applying fast optical initialisation to carrier states and subsequent transfer via dynamic nuclear polarisation (DNP) of the spin information onto long-lived nuclear spin states, with promising applications in quantum information science and novel nuclear magnetic resonance (NMR) techniques. This project aims to develop new, efficient optical pumping schemes to maximise DNP by going beyond the established Overhauser effects, investigating the possibility of self-polarization and phase transitions of the nuclear spin ensemble. An innovating aspect of this proposal is to use valence state engineering to tailor the highly anisotropic dipolar interaction between nuclei and holes, which can lead to novel, non-colinear hyperfine coupling. The next innovation proposed is the development of an all-optical technique AONMR that does not require any radiofrequency (rf) coil set-up capable to control mesoscopic spin ensembles. Contrary to standard NMR techniques based on the generation of macroscopic rf-fields, AONMR can address the nuclear spins in one single nano-object via resonant laser excitation. A further important target is to use quantum dots and other carrier localisation centres as efficient sources of DNP generation and to carry out a detailed study of the diffusion of

DNP throughout the sample and finally across the sample surface, varying key sample (chemical composition, strain, substrate orientation) and experimental parameters such as temperature and applied external fields. These experiments are a feasibility study for using hyperpolarized compound semiconductors for increasing the sensitivity in Magnetic Resonance Imaging (MRI).

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**NBR: 306733** **ACRONYM: NANOSOLID** **EC FUND: 1490318**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE5

**Title:** Chemically Engineered Nanocrystal Solids

**Abstract:** Many materials in the form of well-defined nanoscale crystals ("nanocrystals") exhibit unique properties due to size effects and large surface-to-volume ratios. Yet it is clear that the utilization of nanomaterials in modern technologies requires their integration into solid-state structures with programmable electronic, magnetic and optical properties. The clear challenge is the rational design of this novel type of condensed matter, in which the size-tunable individual properties of nanoscale building blocks are enhanced by their interactions and by the macroscopic properties of their ensembles. The project NANOSOLID will rethink existing approaches and propose radically new strategies for the bottom-up assembly of inorganic entities of various dimensionalities into functional inorganic materials. We identified two clear and interlinked needs that will be addressed: the proper design and understanding of nanocrystal surface chemistry, and the unconventional assembly of nanocrystals into dense nanostructured solids. The union of modern concepts from molecular and supramolecular chemistry will be used to develop nanosolids with predictable geometries and functionalities. We will combine colloidal nanocrystals with other well-established classes of materials aiming at previously unknown crystalline structures composed of strongly interacting species in search for ground-breaking advances in materials design. Among the possibilities for these investigations are covalent and non-covalent, directional and non-directional binding modes, and specific and non-specific interparticle interactions. Together, this project will contribute significantly to the fundamental knowledge about the nanocrystal surface, and will develop new synthetic design tools for complex inorganic solids. Overall, the new materials design platform is expected to bring the long-awaited innovative solutions in energy research, particularly in the areas of thin-film devices for energy conversion and storage.

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**NBR: 306754** **ACRONYM: NANOREAL** **EC FUND: 1272196**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE3

**Title:** Real-time nanoscale optoelectronics

**Abstract:** Is it possible to really 'see' how fast electrons flow in nanoscale optoelectronic circuits? Can we, in this way, get a complete understanding of the real-time dynamics of electrons in nanoscale circuits? The vision of this ERC proposal is to establish a research area at the interface of condensed matter physics, ultrafast optics, and electrical engineering which has so far been nearly completely unexplored: the investigation of real-time dynamics of photoexcited charge carriers in electrically contacted nanosystems with the highest precision possible. By doing so, unique information about the optoelectronic processes in nanoscale circuits shall be obtained. Four interconnected visions are pursued all with applications in information technology and electrical engineering. The approach is risky, however, it promises very interesting physics on the way. We will: (i) explore the fastest and smallest photoswitches fully integrated in electric circuits, (ii) probe single and collective charge excitations for the fastest nanoscale optoelectronic devices, (iii) determine the radiative and non-radiative lifetimes in photovoltaic circuits time-resolved, (iv) discover how fast nanoscale photo-thermoelectric devices operate. Towards these visions, I propose to use a real-time optoelectronic 'on-chip' detection scheme for nanoscale circuits, which was developed by us very recently. In this setup, I intend to carry out time-of-flight experiments of photoexcited electrons in nanoscale circuits, to investigate the ultimate switching speed of optoelectronic devices, and to explore the ultrafast dynamics of photothermo-electric currents in electrically contacted nanosystems. The project gives essential insights for designing and implementing nanoscale circuits into optoelectronic switches, photodetectors, solar cells, thermo-electric devices as well as high-speed off-chip/on-chip communication modules to make ultrafast nanoscale optoelectronics real.

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**NBR: 306772** **ACRONYM: SWIFT** **EC FUND: 1495288**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE7

**Title:** Surface Plasmon-Based Wifi for Nanoscale Optical Information Transport - SWIFT

**Abstract:** This proposal focuses on the design, fabrication, characterization and optimization of novel groundbreaking communication nano-devices. SWIFT proposes resolutely innovative concepts adopting metal-based optical nano-antennas as a disruptive technological vehicle. Nanoscale electronics and photonics exploit novel fascinating physical phenomena and are among the most promising research areas for providing functional nano-components for data transfer and processing. The aim of this proposal is to interface these two device-generating technologies to create the first electrically-driven nanoscale optical antenna transceiver. The concept will enable electron/photon transduction at the nanoscale by a unique surface plasmon-assisted metal-based design, a significant leap at the forefront of research in nanoelectronics and nanophotonics. SWIFT proposes a series of fundamental advances motivated by application-driven

perspectives that will push the burgeoning field of optical antenna to a new area. Deploying optical antenna transceivers enables a paradigm shift in optical interconnects and communication at ultimate device densities through the following innovations: • Development a whole new class of plasmon-assisted transducing optical functional nanodevices.This unique concept addresses the development for ultracompact nanocomponents. • Prototyping self-sustained plasmonic in/out electrical ports on SPP waveguiding platforms, removing thus complex optical interfacing that cannot be miniaturized. • Pioneering a technological breakthrough enabling nanoscale wireless broadcasting of optical information. • Using these functionalities, we will prospect new research directions by proviing a unique ground for (i) generating ultrafast electron surges in an integrated electronic layout enabling ultrafast transport studies in molecular electronics and (ii) for realizing ultrasmall THz sources enabling thus penetration of THz technology at the nanometer-scale.

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**NBR: 306826** **ACRONYM: E-GAMES** **EC FUND: 1499675**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE5

**Title:** Surface Self-Assembled Molecular Electronic Devices: Logic Gates, Memories and Sensors

**Abstract:** Organic electronic devices, such as organic field-effect transistors (OFETs), are raising an increasing interest for their potential in large area coverage and low cost applications. Also, the use of single molecules as active electronic components offers great prospects for the miniaturization of devices and for their compatibility with biological systems. Within this framework, e-GAMES goals are: 1) Molecular logic gates for the storage and transmission of magnetic and optical information and for locally controlling surface wettability. The two huge limitations that hinder the application of molecules in logic gates are: i) Fabrication of devices on a solid support, ii) Concatenation of logic gates. I plan to overcome these drawbacks employing self-assembled monolayers of bistable electroactive molecules. These systems could also be used in the fabrication of surfaces with tunable wettability properties, of high interest in microfluidics and for biosensors. 2) Ambipolar organic field-effect transistors with donor-acceptor systems and their exploitation in light, temperature or pressure sensors, and/or memory devices. Intramolecular electron transfer in organic semiconductors designed for preparing ambipolar OFETs will be explored for the first time. This phenomenon will be exploited for the fabrication of light, pressure or temperature stimuli-responsive OFETs bringing innovative perspectives to the field. 3) Organic/inorganic hybrid devices based on field-effect transistors for sensing environmentally hazardous carbon nanoparticles. Carbon-based nanoparticles are being increasingly used in many applications despite their recognized toxicity. The grounds for the development of a new generation of nanotechnological low-cost and selective sensors based on transistors functionalized with organic sensing molecular monolayers for the detection of such materials will be

developed, contributing towards the improvement of citizens' safety and environmental preservation.

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**NBR: 306972** **ACRONYM: 2DMATER** **EC FUND: 1500000**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE5

**Title:** Controlled Synthesis of Two-Dimensional Nanomaterials for Energy Storage and Conversion

**Abstract:** Two-dimensional (2D) nanosheets, which possess a high degree of anisotropy with nanoscale thickness and infinite length in other dimensions, hold enormous promise as a novel class of ultrathin 2D nanomaterials with various unique functionalities and properties, and exhibit great potential in energy storage and conversion systems that are substantially different from their respective 3D bulk forms. Here I propose a strategy for the synthesis and processing of various 2D nanosheets across a broad range of inorganic, organic and polymeric materials with molecular-level or thin thickness through both the top-down exfoliation of layered materials and the bottom-up assembly of available molecular building blocks. Further, I aim to develop the synthesis of various 2D-nanosheet based composite materials with thickness of less than 100 nm and the assembly of 2D nanosheets into novel hierarchal superstrucutures (like aerogels, spheres, porous particles, nanotubes, multi-layer films). The structural features of these 2D nanomaterials will be controllably tailored by both the used layered precursors and processing methodologies. The consequence is that I will apply and combine defined functional components as well as assembly protocols to create novel 2D nanomaterials for specific purposes in energy storage and conversion systems. Their unique characters will include the good electrical conductivity, excellent mechanical flexibility, high surface area, high chemical stability, fast electron transport and ion diffusion etc. Applications will be mainly demonstrated for the construction of lithium ion batteries (anode and cathode), supercapacitors (symmetric and asymmetric) and fuel cells. As the key achievements, I expect to establish the delineation of reliable structure-property relationships and improved device performance of 2D nanomaterials.

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**NBR: 306983** **ACRONYM: HYSPOD** **EC FUND: 1500000**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE4

**Title:** Hybrid Solution Processable Materials for Opto-Electronic Devices

**Abstract:** This proposal aims at developing, studying the physical properties, and fabricating solar cell devices based on novel hybrid semiconductors. These new hybrids will combine the

electronic properties of colloidal semiconducting nanocrystrals (nanorods) with those of semiconducting organic molecules. Semiconducting nanocrystals are confined systems and therefore are usually not good building blocks for electrical devices. The solution proposed by this ERC project to turn them into efficient components for optoelectronics devices is to build a functional interface between nanocrystals using organic molecules. This will allow extracting charge carriers from these confined systems by means of different physical phenomena including multiple exciton generation. The proposal thus aims to carry out fundamental research as an important step towards making solar cells an economically viable alternative source of energy. The execution of this highly challenging investigation will be based on multidisciplinary expertise in physics, device physics, and physical chemistry and delivered through three well defined, interconnected and targeted key objectives. i) The creation of a fully functional interface for semiconducting nanorods for the extraction of charge carriers; ii) the first fundamental investigation of multiple exciton generation with direct electrical measurement of the photo-excited carriers in these new hybrids based on nanorods; iii) the use of the new hybrid materials for the fabrication of highly efficient low cost solar cells. The applicant is well-established in this field, and has already achieved major breakthroughs in the design, study and fabrication of organic-inorganic hybrids. With the strong support of the Host Institution, she is in a perfect position to deliver on the ambitious goals of this proposal.

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**NBR: 307079** **ACRONYM: TOPOPLAN** **EC FUND: 1496525**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE4

**Title:** Topographically guided placement of asymmetric nano-objects

**Abstract:** The controlled synthesis of nanoparticles in the form of spheres, rods and wires has led to a variety of applications. A much wider spectrum of applications e.g. in integrated devices would be available if a precise placement and alignment relative to neighbouring particles or other functional structures on the substrate is achieved. A potential solution to this challenge is to use top-down methods to guide the placement and orientation of nanoparticles. Ideally, a precise orientation and placement is achieved for a wide range of particle shapes, a so far unresolved challenge. Here we propose to generate a tunable electrostatic potential minimum by exploiting double-layer potentials between two confining surfaces in liquid. The shape of the potential is determined by the local three-dimensional topography of the confining surfaces. This topography can be precisely tailored using the patterning technology that has been developed in our research group. The potential shape can be adapted to fit to a wide range of particle shapes. The trapping energies exceed the thermal energies governing Brownian motion and trap and orient particles reliably. After trapping, the particles are transferred in a subsequent step onto the substrate by external manipulation. The separation of the trapping and placement steps has several unique advantages over existing strategies. High aspect

ratio structures or fragile pre-assembled structures like nanoparticles linked by DNA strands can be pre-aligned in the trapping field and placed in the desired geometry. For applications like the placement of quantum dots into high fidelity cavities, the trapped particles can be examined optically and repelled if the spectral properties do not match. In particular the precise positioning of nanowires is promising to build up complex circuits for (opto-)electronic applications. Additionally, the trapping and placement processes proceed in parallel and high throughput values can be achieved.

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**NBR: 307081** **ACRONYM: POLIGHT** **EC FUND: 1497730**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE5

**Title:** Polymer-Inorganic Flexible Nanostructured Films for the Control of Light

**Abstract:** The POLIGHT project will focus on the integration of a series of inorganic nanostructured materials possessing photonic or combined photonic and plasmonic properties into polymeric films, providing a significant advance with respect to current state of the art in flexible photonics. These highly adaptable films could act either as passive UV-Vis-NIR selective frequency mirrors or filters, or as matrices for light absorbing or optically active species capable of tailoring their optical response. The goal of this project is two-fold. In one aspect, the aim is to fill a currently existing hole in the field of materials for radiation protection, which is the absence of highly flexible and adaptable films in which selected ranges of the electromagnetic spectrum wavelengths can be sharply blocked or allowed to pass depending on the different foreseen applications. In another, the POLIGHT project seeks to go one step beyond in the integration of absorbing and emitting nanomaterials into simple flexible polymeric matrices by including hierarchically structured photonic lattices that provide fine tuning of the optical properties of these hybrid ensembles. This will be achieved by means of enhanced matter-radiation interactions that result from field localization effects at specific resonant modes. The opportunity arises as a result of the recent development of a series of robust inorganic photonic structures that present interconnected porous networks susceptible of hosting polymers and thus inheriting their mechanical properties.

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**NBR: 307104** **ACRONYM: SYNINTER** **EC FUND: 1133565**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE5

**Title:** Smart interrogation of the immune synapse by nano-patterned and soft 3D substrates

**Abstract:** We aim to design smart substrates and suitable detection techniques to understand better the dynamics and spatial organization found in the immunological synapse, with

the ultimate goal of developing new diagnostic tools for sensitive detection of immune deficiency diseases that arise from faulty adhesion. The immunological synapse (IS), formed at the interface between a T-lymphocyte and an antigen presenting cell, has been the target of intense multidisciplinary research in the last decade. Studies point to a crucial role for adhesion mediated by protein clusters for the stability and activity of the synapse. However, even the cluster size - micro or nano scale - remains contentious. Furthermore, while in vivo, the synapse is formed in a soft 3D environment, most in vitro experiments are on hard 2D surfaces. Clearly, one way to probe how the micro/nano environment of the T-cell influences the IS is by interrogating it with artificial substrates that are soft, three dimensionally structured and exhibit motifs down to the cluster length-scale. We shall develop 3D and soft polymeric structures with controlled placement of adhesion molecules and antigens on a single molecule level. The structure, assembly and signalling for stable as well as dynamic IS, on such substrates, will be investigated. Mechano-transduction at IS will be probed by using soft substrates of tunable Youngs modulus. Advanced optical techniques will be developed for quantitative and dynamic mapping of proteins and the cell-cell interface topography. Quantitative reflection interference contrast microscopy, will permit characterization of adhesion of native cells without the need of a special labelling strategy. Our advanced substrates and observation techniques will open up new ways to probe inter-cellular adhesion in general and the immunological synapse in particular. The acquired knowledge will be used for fabricating a cell sensor device for diagnosing T-cell pathology.

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**NBR: 307144** **ACRONYM: MUSTANG** **EC FUND: 1500000**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE3

**Title:** Magnonics Using Spin Torque, spin caloritronics, And Nanoplasmonic engineerinG

**Abstract:** My overall aim is to develop a Magnonic technology platform where Spintronic, Spin-Caloritronic and Nano-plasmonic devices and structures combine to create ground-breaking functionality from novel interactions between charge, spin, heat and light. With traditional Magnonic studies typically geared towards the low GHz range, and nanoplasmonic phenomena primarily focusing on visible light, my proposed platform will also attempt to bridge the so-called “THz gap” and create ultra-broadband and rapidly tuneable spin wave (SW) based signal generators, manipulators, detectors, and even spectrometers, in the 10–200 GHz frequency range. I will reach this goal by transferring my documented nano-contact spin torque oscillator (NC-STO) expertise into the magnonics world of both metal and insulator based SW propagation, add recently discovered spin hall (SHE) and inverse spin hall effect (ISHE) SW manipulation/detection, and combine it with my recently acquired know-how in nanoplasmonics. My specific aims are: 1. SW generation and manipulation using metal and YIG based NC-STOs 2. SW-

light/heat interaction using nanoplasmonic structures and Spin-Caloritronics 3. ISHE/SHE detection and control of propagating SWs in metals and YIG

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**NBR: 307149** **ACRONYM: QSPINMOTION** **EC FUND: 1500000**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE3

**Title:** Quantum coherence and manipulation of a single flying electron spin

**Abstract:** In quantum nanoelectronics, one of the paradigms is to use quantum mechanics in order to build more efficient nanoprocessors. In this context, the electron spin has been identified as a good degree of freedom to store and to manipulate quantum information efficiently. The defined building block of this quantum computer strategy is called a spin qubit. Towards this goal, intense experimental efforts have been invested in AlGaAs heterostructures where quantum dots with only one electron can be realized. In such a system, all the basic operations of a quantum nanoprocessor have been demonstrated in spin qubits and they constitute a very promising platform to study spin dynamics at the single electron level. To scale up the spin qubit system, one has to be able to make two distant qubits interacting. The protocol consists in the exchange of a quantum particle between the two qubits. In this respect, one can take advantage of the fact that a single electron can be transported within nanostructures. Understanding how to preserve quantum information stored in the spin of an electron while transferring it between two quantum dot systems is of crucial importance. Recently, the PI has realized a first important step towards this goal, namely the realization of efficient single electron transfer between two distant quantum dots on a timescale faster than the spin decoherence time Here we propose to give a new dimension to the spin qubit system by investigating quantum coherence and manipulation of a single flying electron spin. Displacing coherently a single electron spin between two distant quantum dots not only represents a viable solution towards entanglement between distant qubits but also opens new ways of manipulating coherently electron spins via spin-orbit interaction. The new knowledge expected from these experiments is likely to have a broad impact extending from quantum spintronics to other areas of nanoelectronics.

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**NBR: 307161** **ACRONYM: HIPERBAT** **EC FUND: 1497838**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE4

**Title:** Hunting for high performance energy storage in batteries

**Abstract:** One of the great challenges of this century is unquestionably energy storage. Storage is essential to make more efficient use of renewable energy sources and to enable

electrical mobility. Recent developments have raised both hopes and fundamental challenges in the next generation Li batteries (including Li-ion and Li-air/Li-sulphur). Despite large research efforts, the improvement of battery performance over the last decades has been relatively small because the full potential of the storage materials is not utilized. Most of the attention has been devoted to the development of new electrode materials; however, marginal understanding has been achieved of the functioning of these materials in electrodes. The key problem is that established micro and macroscopic methods are not sensitive to the relevant time and length scales under the required in-situ conditions. Moreover, up to date calculational models do not represent the full complexity of the electrode systems. Using novel experimental and calculational approaches this project aims at fundamental understanding and improvement of Li electrodes. This requires a broad multidisciplinary approach, ranging from nuclear magnetic resonance probing nanoscopic charge transfer to in-situ neutron depth profiling exploring the mesoscopic charge transport. Calculations will combine the complex solid state diffusion in storage materials with the mesoscopic charge transport through the electrodes. By systematic variation of the electrode micro and nanostructure, this will lead to deep fundamental understanding. This project will be the first major systematic study on the fundamentals of complete electrodes. By bringing our current understanding from the level of the storage material towards complete electrodes, it will also pave the way to optimal high performance energy storage in batteries. The impact on society cannot be overstated as energy storage is a key enabler for the use of renewable energy and electrical transport.

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**NBR: 307267** **ACRONYM: MAGNETIC BEAMS** **EC FUND: 1850000**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE4

**Title:** Magnetically manipulated molecular beams

**Abstract:** This proposal is aimed at developing and applying novel ultra-sensitive methods for studying the structure and dynamics of surfaces on an atomic scale, focusing on water surfaces in particular. The proposal consists of two main instrument development projects which are based on magnetic manipulation of molecular beams: (1) Developing a ground-breaking apparatus which uses a pre-polarized H2O molecular beam in order to perform NMR measurements on dilute surface science systems, measurements which were impossible using conventional NMR approaches. (2) Developing a unique second-generation helium spin echo spectrometer which is sensitive to motion on an unprecedentedly wide time scale range. This instrument will be capable of measuring atomic scale surface dynamics of systems which were previously beyond the realm of experimentalists. Both of these novel instruments will be primarily used to study the atomic scale structure and dynamics of water surfaces. Studying these systems is particularly challenging due to the delicate and complex nature of the surface, nevertheless, there is an extensive interest in studying water surfaces due to the key

role they play in a wide range of research fields and applications. Examples include atmospheric chemistry, where ozone depleting reactions are catalyzed on ice surfaces, Material sciences and nano-technology, where the interaction and reactivity of a surface with water can determine the performance of novel miniature devices and even astrophysics where star birth reactions take place on ice surfaces. We intend to exploit the new contrast mechanisms and the unique time scales made available by the novel instruments we will develop, in order to obtain new experimental insights into this exciting research field.

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**NBR: 307338** **ACRONYM: NAMIC** **EC FUND: 1264640**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE3

**Title:** Nanowire Atomic Force Microscopy for Real Time Imaging of Nanoscale Biological Processes.

**Abstract:** Short summary: The ability to measure structures with nanoscale resolution continues to transform physics, materials science and life science alike. Nevertheless, while there are excellent tools to obtain detailed molecular-level static structure (for example in biology), there are very few tools to develop an understanding of how these structures change dynamically as they fulfill their biological function. New biologically-compatible, high-speed nanoscale characterization technologies are required to perform these measurements. In this project, we will develop a nanowire-based, high-speed atomic force microscope (NW-HS-AFM) capable of imaging the dynamics of molecular processes on living cells. We will use this instrument to study the dynamic pore-formation mechanisms of novel peptide antibiotics. This increase in performance over current AFMs will be achieved through the use of electron-beam-deposited nanogranular tunneling resistors on prefabricated nanowire AFM cantilevers. By combining these cantilevers with our state of the art high-speed AFM technology, we expect to obtain nanoscale-resolution images of protein pores on living cells at rates of tens of milliseconds per image. This capability will open a whole new arena for seeing nanoscale life in action.

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**NBR: 307357** **ACRONYM: INFIBRENANOSTRUCTURE** **EC FUND: 1495400**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE5

**Title:** Fabrication and characterization of dielectric encapsulated millions of ordered kilometer-long nanostructures and their applications

**Abstract:** The objective of this project is the realization of a radically new nanowire fabrication technique, and exploration of its potential for nanowire based science and technology. The proposed method involves fabrication of unusually long, ordered nanowire and nanotube arrays in macroscopic fibres by means of an iterative thermal co-drawing process. Starting with a macroscopic rod with an annular hole tightly fitted with another rod of another compatible material, by successive thermal drawing we obtain arrays of nanowires embedded in fibres. With the method, wide range of materials, e.g. semiconductors, polymers, metals, can be turned into ordered nanorods, nanowires, nanotubes in various cross-sectional geometries. Main challenges are the thermal drawing steps that require critical matching of the viscoelastic properties of the protective cover with the encapsulated materials, and the liquid instability problems and phase intermixing with higher temperatures and smaller feature sizes that require high thermal and mechanical precision. Initially, fabrication by drawing will begin with soft amorphous semiconductors, phase change materials, polymers of interest in high temperature polymers, followed by a wider range of materials, low melting temperature metals, metals and common semiconductors (Si, Ge) in silica glass matrices. In this way nanowires that are ordered, easily accessible and hermetically sealed in a dielectric encapsulation will be obtained in high volumes. Potentially, these nanowires are advantages over on-chip nanowires in building flexible out of plane geometries, light weight, wearable and disposable devices. Ultimately, attaining ordered arrays of 1-D nanostructures in an extended flexible fibre with high yields will facilitate sought-after but up-to-now difficult applications such as the large area nanowire electronics and photonics, nanowire based scalable phase-change memory, nanowire photovoltaics, and emerging cell-nanowire interfacing.

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**NBR: 307370** **ACRONYM: HQ-NOM** **EC FUND: 1792140**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE2

**Title:** Hybrid Quantum Nano-Optomechanics

**Abstract:** The chief endeavor of the project is to develop, investigate and exploit systems associating nanoscale mechanical resonators with single quantum objects. Such combinations belong in the category of so-called “hybrid nanomechanical systems” which constitutes a rapidly expanding field in modern quantum- and nanophysics. The benefit of exploring hybrid systems is manifold. From a practical point of view, due to their size, nanoresonators are extremely sensitive to external forces. If associated with a high resolution optical sensor through which the nanoresonator can be non-invasively probed and manipulated, the hybrid system holds promise to act as an ultrasensitive force probe. On a more fundamental level, unexplored quantum regimes become within reach, where the interface between quantum objects and mechanical systems can be thoroughly investigated. From a conceptual point of view, such experiments are of paramount importance as they could reveal the quantum behavior of macroscopic

objects. To accommodate these ideas, I propose to develop and investigate two types of hybrid systems. The first one consists of a single nitrogen-vacancy (NV) defect hosted in a diamond nanocrystal, positioned at the extremity of a nanowire. My team and I recently demonstrated magnetic coupling of the NV spin to the resonator position and thereby evidenced the feasibility of realizing such a quantum to mechanical interface. This novel system can readily be improved to meet the severe requirements of the quantum opto-mechanical experiments envisioned in this project. The second approach also exploits a NV centre, but this time as an integrated part of a diamond resonator. This monolithic system potentially offers an unprecedented coupling, a supreme overall stability, and NV centres with improved characteristics, together expanding the scope of conceivable experiments.

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**NBR: 307384** **ACRONYM: NANOTRIGGER** **EC FUND: 1699320**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE8

**Title:** Triggerable nanomaterials to modulate cell activity

**Abstract:** The advent of molecular reprogramming and the associated opportunities for personalised and therapeutic medicine requires the development of novel systems for on-demand delivery of reprogramming factors into cells in order to modulate their activity/identity. Such triggerable systems should allow precise control of the timing, duration, magnitude and spatial release of the reprogramming factors. Furthermore, the system should allow this control even in vivo, using non-invasive means. The present project aims at developing triggerable systems able to release efficiently reprogramming factors on demand. The potential of this technology will be tested in two settings: (i) in the reprogramming of somatic cells in vitro, and (ii) in the improvement of hematopoietic stem cell engraftment in vivo, at the bone marrow. The proposed research involves a team formed by engineers, chemists, biologists and is highly multidisciplinary in nature encompassing elements of engineering, chemistry, system biology, stem cell technology and nanomedicine.

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**NBR: 307442** **ACRONYM: GALATEA** **EC FUND: 1757396**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE8

**Title:** Tailoring Material Properties Using Femtosecond Lasers: A New Paradigm for Highly Integrated Micro-/Nano- Scale Systems

**Abstract:** Using recent progress in laser technology and in particular in the field of ultra-fast lasers, we are getting close to accomplish the alchemist dream of transforming materials.

Compact lasers can generate pulses with ultra-high peak powers in the Tera-Watt or even Peta-Watt ranges. These high-power pulses lead to a radically different laser-matter interaction than the one obtained with conventional lasers. Non-linear multi-photons processes are observed; they open new and exciting opportunities to tailor the matter in its intimate structure with sub-wavelength spatial resolutions and in the three dimensions. This project is aiming at exploring the use of these ultrafast lasers to locally tailor the physical properties of glass materials. More specifically, our objective is to create polymorphs embedded in bulk structures and to demonstrate their use as means to introduce new functionalities in the material. The long-term objective is to develop the scientific understanding and technological know-how to create three-dimensional objects with nanoscale features where optics, fluidics and micromechanical elements as well as active functions are integrated in a single monolithic piece of glass and to do so using a single process. This is a multidisciplinary research that pushes the frontier of our current knowledge of femtosecond laser interaction with glass to demonstrate a novel design platform for future micro-/nano- systems.

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**NBR: 307450** **ACRONYM: HYBRIDNET** **EC FUND: 1500000**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE2

**Title:** Hybrid Quantum Networks

**Abstract:** The development of correlated quantum networks based on interconnected material nodes and quantum channels is a major challenge for the field of quantum information science, including quantum communication, computing, and metrology. Two main encodings of quantum information are generally used: a 'discrete-variable' encoding based for instance on single-photons and a 'continuous-variable' approach which relies on continuous degrees of freedom, such as the quadrature components of light modes. A mostly unexplored area is the mixing of these two approaches leading to 'hybrid schemes' where the advantages of both paradigms can be merged. This is the subject of the present proposal. Stated succinctly, we aim at developing the scientific and technical foundations for the realization of hybrid quantum networks with applications to the distribution and processing of quantum information. The new research activities that we propose to undertake are as follows: • The implementation of storage and subsequent rotation of a hybrid qubit • The laboratory demonstration of storage, readout and subsequent purification of continuous-variable entanglement • The experimental realization of a segment of a hybrid quantum repeater We will reach these objectives by developing compatible quantum light source (pulsed optical parametric oscillator) and light-matter interface (cold atoms trapped in the vicinity of elongated nanofibers) and by demonstrating novel capabilities for hybrid protocols, such as non-Gaussian state storage and quantum gates. These activities will be accompanied by a strong theoretical effort focused on the development of resource-efficient hybrid protocols for improved scaling.

**NBR: 307502** **ACRONYM: E-CONTROL** **EC FUND: 1499465**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE3

**Title:** Electric-Field Control of Magnetic Domain Wall Motion and Fast Magnetic Switching: Magnetoelectrics at Micro, Nano, and Atomic Length Scales

**Abstract:** The aim of the proposed research is to study electric-field induced magnetic phenomena in thin-film ferromagnetic-ferroelectric heterostructures. In particular, the project addresses ferroic order competition and magnetoelectric coupling dynamics at micro, nano, and atomic length scales. The first part of the project focuses on the dynamics of coupled ferromagnetic-ferroelectric domains and electric-field induced magnetic domain wall motion at sub-nanosecond time scales. For simultaneous imaging of both ferroic domain responses to ultra-short electric-field pulses, the construction of a time-resolved polarization microscope is proposed. The second part relates to finite-size scaling of ferroic domain correlations in continuous films and electric-field control of magnetic effects in patterned nanostructures. Here, the aim is to elucidate the competition between magnetoelectric coupling at ferromagnetic-ferroelectric interfaces and the relevant energy scales within the bulk of ferroic materials. Moreover, electric-field induced domain wall motion in magnetic nanowires is pursued as a viable low-power alternative to current-driven spin-torque effects. Finally, the third part of E-CONTROL aims at visualization of magnetoelectric coupling effects with atomic precision. For this frontier study, the development of in situ transmission electron microscopy (TEM) techniques is proposed. The new measurement method enables the application of local electric fields on cross-sectional specimen during TEM analysis and this is bound to provide unique insights in strain-mediated and charge-modulated coupling mechanisms between ferromagnetic and ferroelectric thin films.

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**NBR: 307523** **ACRONYM: LIGHT** **EC FUND: 1999485**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE4

**Title:** advanced Light mIcroscopy for Green cHemisTry

**Abstract:** Optimization of catalytic materials and hence of chemical processes heavily relies on gaining detailed insight into the complex dynamics underlying the outcome of a catalytic process and using this information in the rational design of improved catalysts. So far, spectroscopic approaches have already contributed importantly; however a strong need for new and improved in situ spectroscopic methods with micro- and nanometer

resolution still remains. This project aims to develop advanced light microscopy tools that will significantly contribute to this goal.

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**NBR: 307596** **ACRONYM: OTEGS** **EC FUND: 1453689**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE3

**Title:** Organic Thermoelectric Generators

**Abstract:** At the moment, there is no viable technology to produce electricity from natural heat sources (T0.8 at room temperature: (i) by optimizing not only the power factor but also the thermal conductivity; (ii) by demonstrating that a large power factor is obtained in inorganic-organic nanocomposites. Secondly, we will optimize thermoelectrochemical cells by considering various types of electrolytes. The research activities proposed are at the cutting edge in material sciences and involve chemical synthesis, interface studies, thermal physics, electrical, electrochemical and structural characterization, device physics. The project is held at Linköping University holding a world leading research in polymer electronics.

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**NBR: 307609** **ACRONYM: MINT** **EC FUND: 1444999**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE5

**Title:** Mechanically Interlocked Carbon Nanotubes

**Abstract:** We present a plan to design, synthesize and exploit the properties of mechanically interlocked carbon nanotubes (MINTs). The scientific aim of the project is to introduce the mechanical bond as a new tool for the derivatization of carbon nanotubes. The mechanical link combines the advantages of covalent and supramolecular modifications, namely: kinetic stability (covalent) and conserved chemical structure (supramolecular). Besides this, its dynamic nature opens up unique opportunities for both fundamental studies and applications. From a technological point of view, MINTs should have a practical impact in the fields of molecular electronics and molecular machinery. A general modular approach to MINT-based materials for photovoltaic devices and electrochemical sensors is presented. We also expect to exploit the rigidity and low dimensionality of SWNTs to construct molecular machines that utilize them as tracks to move across long distances, which is not possible in small-molecule molecular machines. To achieve these goals we will exploit the PI's expertise in the chemical modification of carbon nanostructures, in the self-assembly of electroactive materials and in the synthesis and characterization of mechanically interlocked molecules.

**NBR: 307624** **ACRONYM: TDRFSP** **EC FUND: 1497000**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE7

**Title:** Time-Domain RF and Analog Signal Processing

**Abstract:** One of the most important developments in the communication microelectronics in the last decade was the invention and popularization of "Digital RF". It transforms the radio frequency (RF) analog functionality of a wireless transceiver into digitally-intensive implementations that operate in time-domain. They are best realized in mainstream nanometer-scale CMOS technologies and easily integrated with digital processors. As a result, RF transceivers based on this new approach now enjoy significant benefits. Consequently, the RF transceivers based on this architecture are now the majority of the 1.5 billion mobile handsets produced annually. The invention and development of "Digital RF" was pioneered in the last decade by this applicant at Texas Instruments in Dallas, Texas, USA. Despite having published over 130 scientific papers, that industrial research focus has been mainly limited to the highest volume segment of the wireless communications market: low-cost GSM/EDGE cellular phones and Bluetooth radios. Unfortunately, that low-cost low-data-rate market segment has already reached the saturation. The fastest growing segments of the wireless communications are now: high-data-rate "smart phones", ultra-low-power wireless sensor network devices, antenna-array and millimeter-wave transceivers, where the original "Digital RF" approach could not be readily exploited. The goal of this proposal is to revisit and exploit the fundamental theory of the time-domain operation of RF and analog circuits. This way the broad area of the wireless communications, as well as analog and mixed-signal electronics in general, can be transformed for the ready realization in the advanced CMOS technology. This is expected to revolutionize the entire research field to even a larger extent than the "Digital RF" breakthrough in low-cost low-data-rate radios pioneered by this applicant in the last decade.

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**NBR: 307629** **ACRONYM: ADAPT** **EC FUND: 1476882**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE6

**Title:** Theory and Algorithms for Adaptive Particle Simulation

**Abstract:** During the twentieth century, the development of macroscopic engineering has been largely stimulated by progress in digital prototyping: cars, planes, boats, etc. are nowadays designed and tested on computers. Digital prototypes have progressively replaced actual ones, and effective computer-aided engineering tools have helped cut

costs and reduce production cycles of these macroscopic systems. The twenty-first century is most likely to see a similar development at the atomic scale. Indeed, the recent years have seen tremendous progress in nanotechnology - in particular in the ability to control matter at the atomic scale. Similar to what has happened with macroscopic engineering, powerful and generic computational tools will be needed to engineer complex nanosystems, through modeling and simulation. As a result, a major challenge is to develop efficient simulation methods and algorithms. NANO-D, the INRIA research group I started in January 2008 in Grenoble, France, aims at developing efficient computational methods for modeling and simulating complex nanosystems, both natural and artificial. In particular, NANO-D develops SAMSON, a software application which gathers all algorithms designed by the group and its collaborators (SAMSON: Software for Adaptive Modeling and Simulation Of Nanosystems). In this project, I propose to develop a unified theory, and associated algorithms, for adaptive particle simulation. The proposed theory will avoid problems that plague current popular multi-scale or hybrid simulation approaches by simulating a single potential throughout the system, while allowing users to finely trade precision for computational speed. I believe the full development of the adaptive particle simulation theory will have an important impact on current modeling and simulation practices, and will enable practical design of complex nanosystems on desktop computers, which should significantly boost the emergence of generic nano-engineering.

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**NBR: 307679** **ACRONYM: STOMAMOTOR** **EC FUND: 1500000**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE5

**Title:** Stomatocyte Nanomotors: Programmed Supramolecular Architectures for Autonomous Movement

**Abstract:** The main goal of this ERC proposal is to harness a completely new approach to constructing biocompatible nanomotors, using supramolecular assembly of amphiphilic block-copolymers for loading the engine and catalysis as the driving force for autonomous movement. Polymersomes assembled from amphiphilic block copolymers can be further re-engineered to perform a controlled shape transformation from a thermodynamically stable spherical morphology to a kinetically trapped stomatocyte structure with controlled opening. These stable structures can selectively entrap catalytically active nanoparticles within their nanocavity making their design ideal for nanoreactor applications. The decomposition of hydrogen peroxide by an entrapped catalyst has been shown to generate a rapid discharge of gases and consequently generate thrust and directional movement. The design of the loaded stomatocytes is a truly miniature monopropellant rocket engine in which the catalytically active nanoparticles are the motor, the hydrogen peroxide is the propellant and the controlled opening of the stomatocyte is the nozzle. Their unique shape allows for added capabilities, extra compartmentalization for loading efficiency, polymeric PEG surface

for biocompatibility and entrapped particles for catalytic activity. The supramolecular approach to assembling the motor allows facile alteration of its constituent parts: motor, fuel and cargo to make it more suitable for biological applications (type of catalytic particles, surface modification for cellular uptake or suitable biofuels). The appropriate design of the motor with recognition sites on the surface can facilitate the recognition, isolation and transport of specific type of cells, or can navigate the payloads within the cell via chemotaxis. Besides their initial role to overcome random diffusion, these “ship-in-a-bottle” loaded stomatocytes open interesting possibilities for designing new targeted drug delivery and nanoreactor systems.

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**NBR: 307687** **ACRONYM: NAQUOP** **EC FUND: 1500000**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE3

**Title:** Nanodevices for Quantum Optics

**Abstract:** We propose developing a nanodevice toolbox for single photon quantum optics. A scalable scheme to generate indistinguishable single photons, an interface to couple single photon polarization to a single electron spin and high efficiency single photon detectors represent the core of the scientific problems to be addressed in this project. We set the following research objectives: 1- Understand to what extent quantum dots can be made indistinguishable. 2- Interface coherently single photons to single electron spins via strain engineering in quantum dots. 3- Gain a better understanding of the limits to time resolution and detection efficiency of ultrafast superconducting single photon detectors. The proposed research effort will yield novel experiments: the realization of scalable indistinguishable quantum dot sources by frequency locking single quantum dots to atomic transitions, the demonstration of new selection rules in semiconductor nanostructures to couple photon polarization to the electron spin only, the development of ultrafast and high efficiency single photon and single plasmon detectors and their implementation in two photon interference and quantum plasmonics experiments. To carry out the work, multidisciplinary efforts where nanofabrication, quantum optics, semiconductor and superconductor physics will be merged to demonstrate the scalability of quantum dots for quantum information processing, providing crucial new knowledge in single photon optics at the nanoscale. The impact of the project will be important and far reaching as it will address fundamental questions related to the scalability of quantum indistinguishability of remote nanostructures.

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**NBR: 307755** **ACRONYM: FIN** **EC FUND: 1400341**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE4

**Title:** Theory of Fundamental Interactions at the Nanoscale

**Abstract:** At the heart of this multi-disciplinary research project lie two emerging prominent theoretical models developed by the applicant in the past 12 months, which underpin the fundamental interactions taking place at the nanometre scale. In 2010, the applicant proposed a general solution to the fundamental problem of the attraction between like-charged dielectric nanoparticles. This is the first time a comprehensive solution to this problem has been presented, and it has the potential to transform our understanding of how charged nanoparticles interact in the gas phase and solutions. Studies of nanoparticles have opened new avenues for exploration of the principles that underpin the transition from the gas phase to the solid state. The capability of nanoparticles to modify their shape in order to minimize the free energy leads to structure modifications that can be observed on a time scale accessible by electron microscopy techniques. A unique computational methodology has been developed by the applicant, which has an advantage over the state-of-the-art image simulation techniques in its ability to simulate the dynamics of structural transformations under the influence of the electron beam. The proposed core theoretical frameworks are central tools of the project. Their fundamental nature offers solutions to problems across wide-ranging disciplines. The models will be advanced during the project and introduced to the experts in the application areas in order to find solutions to a number of common problems, which to date remain un-solved. The application areas, which will be addressed, include the electrostatic charging of pharmaceutical powders during manufacture and handling; the charge scavenging in the formation of solar systems; self-assembly of charged nanoparticles in solutions; proton transfer in biological molecules; structure-property correlations of nanomaterials; and design of innovative oxidation catalysts using inorganic polyoxometalates.

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**NBR: 307760** **ACRONYM: SURFPRO** **EC FUND: 1486061**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE4

**Title:** Tuning electronic surface properties by molecular patterning

**Abstract:** Inspired by the possibility to create an artificial electronic band structure through the interplay of a molecular nanoporous network with the surface state electrons of a metallic substrate (recently reported by us), the utilization of this new concept for controlling the electronic surface properties of a material as well as establishing understanding of the underlying principles for the observed behavior is the overall aim of this project. The modification of the electronic surface properties also affects the material properties in general, such as conductivity, surface catalysis properties and reflectivity. Thus, the proposed concept has great potential for materials research and will ultimately result in the development of new materials with adjustable electronic properties. Such materials will find applications in e. g. (nano)electronic devices or

sensors. The plan is to make use of supramolecular self-assembly and such, to fabricate nanoporous networks from specially designed molecular building blocks on either metallic substrates having a surface state or graphene. Since both the metallic substrates and graphene feature a quasi free 2D electron gas it is assumed that quantum confinement will appear in the pores of the network leading to confined states. Due to the coupling of these confined states, an artificial electronic band structure is expected to form. Moreover, in the case of graphene the opening of a band gap is expected to occur which is a prerequisite for the implementation of graphene in electronic devices. With the help of scanning tunneling microscopy and photoelectron spectroscopy measurements the confinement properties of different nanoporous networks will be studied with respect to pore to pore distance, pore diameter, effect of the interplay between intermolecular and molecule substrate interactions, effect of trapping guest molecules in the pores and coupling strength between graphene and its support layer.

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**NBR: 307778** **ACRONYM: CIRQYS** **EC FUND: 1456608**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE3

**Title:** Circuit QED with hybrid electronic states

**Abstract:** We propose to develop a new scheme for detecting and manipulating exotic states formed by combinations of conductors with different dimensionalities and/or electronic orders. For that purpose, we will use tools of cavity quantum electrodynamics to study in a very controlled way the interaction of light and this exotic matter. Our experiments will be implemented with nanowires connected to normal, ferromagnetic or superconducting electrodes embedded in high finesse on-chip superconducting photonic cavities. The experimental technique proposed here will inaugurate a novel method for investigating the spectroscopy and the dynamics of tailored nano-systems. During the project, we will focus on three key experiments. We will demonstrate the strong coupling between a single spin and cavity photons, bringing spin quantum bits a step closer to scalability. We will probe coherence in Cooper pair splitters using lasing and sub-radiance. Finally, we will probe the non-local nature of Majorana bound states predicted to appear at the edges of topological superconductors via their interaction with cavity photons.

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**NBR: 307784** **ACRONYM: PHELIX** **EC FUND: 1496400**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE5

**Title:** Photo-Engineered Helices in Chiral Liquid Crystals

**Abstract:** Supramolecular helices are a striking expression of chirality which is found at every level of biological materials, from plant cell walls to bones. Helical biomaterials formed out of equilibrium display multiple length scales, adaptation of structure to function and responsiveness to changing environments, a unique set of features that constitutes a fascinating source of inspiration for materials science. However, matching the complexity of these biological architectures by rational design of synthetic systems remains a major contemporary challenge. The aim of this project is to develop sophisticated helical materials with responsive architectures that are of interest in optical communication, energy management, photonic materials and mechanical actuation. The innovative and versatile approach proposed here consists in using light i) to engineer the period, handedness and orientation of the cholesteric helix, and ii) to stabilise the structures formed out of equilibrium by in-situ formation of polymer networks. Three tasks will run concurrently: Task 1: Stimuli-responsive infrared super-reflectors Task 2: Dynamic templates for long range ordering of nano-objects Task 3: Photomechanical actuation of helicoids and spiral ribbons "Phelix" will yield complex systems that reach beyond the state of the art in stimuli-responsive materials, push the frontiers of research on supramolecular helices and shed new light on transmission of chirality across length scales. Ultimately, the omnipresence of helical structures in nature means that biomedical applications could be envisioned also. The proposal builds on my recent investigations on light-responsive helices in cholesteric liquid crystals. I have demonstrated the expertise in liquid crystals, photochemistry and microscopy required for this research and my leadership experience ensures its success.

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**NBR: 307800** **ACRONYM: PHOTOSMART** **EC FUND: 1499878**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE7

**Title:** Photo-switching of smart surfaces for integrated biosensors

**Abstract:** Smart surfaces with switchable properties hold great promise for future integrated sensors. Azobenzene molecules have been demonstrated to switch reversibly between the trans and cis isomer with picosecond time constants, when triggered with an external light source. Due to the different molecular geometries and electronic properties of the isomers, these may be used as molecular switches for realizing smart surfaces. The objective of this research proposal is to establish methods for integrating photo-switchable smart surfaces into miniaturized sensors. For efficient switching this requires on-chip light sources providing sufficient intensity at the location of the molecular switch. Ultraviolet and blue organic light emitting diodes will be integrated monolithically onto dielectric substrates with a periodically nanostructured high refractive index layer. This slab photonic crystal allows for resonant excitation of the molecular switches. Two types of smart surfaces will be studied. First, the reversible switching of wettability between hydrophilic and hydrophobic will be investigated, which is of particular importance for reconfigurable microfluidic chips. Second, the

switchable surface adsorption of biomaterials is targeted. The periodic switching of the binding sites between an active and an inactive state will cause a periodic measurement signal. This allows for the use of lock-in techniques with superior signal-to-noise ratio and for subtraction of the background at same position. Combining both types of smart surfaces promises reconfigurable, multifunctional, highly-selective future integrated biosensors. The final goal of the proposed project is to demonstrate for the first time an integrated microsystem with smart surfaces switched by on-chip light sources for spatial and temporal control of the surface wettability as well as control of binding sites for biomolecules.

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**NBR: 307806** **ACRONYM: CARBONLIGHT** **EC FUND: 1466000**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE3

**Title:** Tunable light tightly bound to a single sheet of carbon atoms: graphene as a novel platform for nano-optoelectronics"

**Abstract:** Graphene, a one-atom-thick layer of carbon, has attracted enormous attention in diverse areas of applied and fundamental physics. Due to its unique crystal structure, charge carriers have an effective mass of zero and a very high mobility, even at room temperature. While graphene-based devices have an enormous potential for high-speed electronics, graphene has recently been recognized as a photonic material for novel optoelectronic applications. Interestingly, graphene is also a promising host material for light that is confined to nanoscale dimensions, more than 100 times below the diffraction limit. Due to its ultra-small thickness and extremely high purity, graphene can support strongly confined propagating light fields coupled to the charge carriers in the material: surface plasmons. The properties of these plasmons are controllable by electrostatic gates, holding promise for in-situ tunability of light-matter interactions at a length scale far below the wavelength. This project will experimentally investigate the new and virtually unexplored field of graphene surface plasmonics, and combine this with other appealing properties of graphene to demonstrate the unique potential of carbon-based nano-optoelectronics. The aim is to explore the limits of unprecedented light concentration, manipulation and detection at the nanoscale, to dramatically intensify nonlinear interactions between photons towards the quantum regime, and to reveal the subtle effects of cavity quantum electrodynamics on graphene-emitter systems. This research will reveal the far-reaching potential of a single sheet of carbon atoms as a host for light and electrons at the nanoscale, with prospects for novel nanoscale optical circuits and detectors, nano-optomechanical systems and tunable artificial quantum emitters.

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**NBR: 307940** **ACRONYM: SMART** **EC FUND: 1448400**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE3

**Title:** Statistical Mechanics of Active Matter

**Abstract:** The study of living matter has to be considered as an exciting and substantive part of the modern definition of physics. Whether a general statistical mechanics exists for broad classes of of active systems and what is the quantitative predictive power that we could expect from those theories remain still open and debated questions. Reductionism and approximations, the most powerful weapons of theoretical physicists have to face a degree of complexity that has no analogue in non living matter. That results in a number of phenomenological parameters whose connection to microscopic quantities is rarely supported by experimental data. Moreover some of the most peculiar and potentially groundbreaking properties of active matter can only be evidenced in the presence of external force fields and are still largely unexplored. We propose to combine frontier research tools for 3D holographic micromanipulation and 3D two-photon microfabrication to gain an unprecedented active role in probing active matter dynamics, from few bodies interactions up to collective behavior. For example, we will study bacteria interactions by grabbing, orienting and releasing individual bacteria in a sort of bacteria-bacteria scattering experiments. On the other hand optical energy landscapes, which can be structured in space and time, will allow to study collective response to the tunable and smooth fields that are particularly suited for theoretical treatment. Furthermore two-photon lithography will allow the microfabrication of arbitrarily shaped 3D structures that will be used as probes for the highly non-trivial correlations and response functions in non equilibrium active baths. Besides providing a playground for theoretical developments in non-equilibrium physics, this project will explore novel opportunities to exploit active matter as a SMART material, capable of performing useful tasks in micro and nano engineered devices.

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**NBR: 308023** **ACRONYM: FLEXOELECTRICITY** **EC FUND: 1478400**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE3

**Title:** Flexoelectricity

**Abstract:** Flexoelectricity is a general property of all insulators whereby they generate a voltage when subjected to an inhomogeneous deformation such as bending. Research on this property has taken off with the observation that, due to the large gradients they can accommodate, devices operating in the nanoscale display colossal flexoelectric effects. The present proposal aims to set up Euroe's first laboratory specialized on the exploration and exploitation of flexoelectricity. It shall focus on three areas with specific targets: 1) Flexoelectricity for energy harvesting: the inverse relationship between flexoelectricity and device size means that, at the nanoscale, flexoelectric energy

harvesting can deliver electromechanical performances superior to the current state of the art. We aim to demonstrate record-high effective piezoelectric coefficients through the use of flexoelectricity. 2) Flexoelectricity for information technologies: Flexoelectricity affords mechanical control of polarity. This opens the door to novel memory device concepts where polarization (and magnetization) can be controlled by pushing with the tip of a scanning probe. We aim to achieve flexoelectric writing of domains under electrodes, and also to demonstrate the indirect coupling between flexoelectricity and magnetization ("flexomagnetism"). 3) Bioflexoelectricity: Flexoelectricity participates in human hearing, and is expected to participate in other bioelectric phenomena. In particular, bones are known to generate electricity in response to stress, and it has been hypothesised that this is due to strain gradients; if demonstrated, this would represent a significant step towards osteogenetic implants. Determining the role of flexoelectricity in in bone piezoelectricty will be the third aim of this project.

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**NBR: 308051** **ACRONYM: MOLSPINTRON** **EC FUND: 1467200**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE5

**Title:** Synthetic Expansion of Magnetic Molecules Into Spintronic Devices

**Abstract:** Molecular spintronics is emerging as a rapidly growing field at the interface of inorganic molecular chemistry, surface sciences, and condensed matter physics fueled by both the fundamental interest in the underlying charge and spin transport mechanisms, and the prospects of the combined exploitation of molecular charge and spin states in a revolutionary new class of molecular-based ultra-low power devices translating their spin/charge response characteristics into novel, non-trivial functionalities. The research project proposes a range of innovative synthetic functionalization strategies of magnetic molecules that allow for targeted multi-terminal contacting of individual molecules in an approach representing a paradigm shift from existing top-down contact techniques in molecular spintronics. The project aims to reverse this existing approach and focuses on multi-step growth, controllable at the molecular level, of metallic electrode structures directly originating at a molecular magnet, as well as on controlled anchoring of the magnetic molecules to metal oxide surfaces of gate electrodes. Central to the proposal are magnetically functionalized polyoxometalates which provide a range of advantages relevant to molecular spintronics such as high stability, redox activity, structural versatility, tuneability of their molecular magnetic structures, as well growth strategies of metallic nanostructures such as quantum size-effect-controlled growth of metallic island structures. The synthetic expansion of molecule-attached metal nanocluster precursor structures into functional multi-terminal contacts addressable by multi-tip STM setups will lead to a breakthrough in reproducible charge transport measurements of single magnetic molecules and access to their fascinating Kondo physics, while the

targeted technological breakthrough targets a chemically controlled integration of single magnetic molecules into nanostructured environments of spintronic devices.

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**NBR: 308074** **ACRONYM: ELITE** **EC FUND: 1470736**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE10

**Title:** Early Life Traces, Evolution, and Implications for Astrobiology

**Abstract:** Tracking the early traces of life preserved in very old rocks and reconstructing the major steps of its evolution is an exciting and most challenging domain of research. How amazing it is to have a cell that is 1.5 or 3.2 billion years old under a microscope! From these and other disseminated fragments of life preserved along the geological timescale, one can build the puzzle of biosphere evolution and rising biological complexity. The possibility that life may exist beyond Earth on other habitable planets lies yet at another scale of scientific debates and popular dreams. We have the chance now to live at a time when technology enable us to study in the finest details the very old record of life, or to land on planets with microscope and analytical tools, mimicking a geologist exploring extraterrestrial rocky outcrops to find traces of water and perhaps life. There is still a lot to be done however, to solve major questions of life evolution on Earth, and to look for unambiguous life traces, on Earth or beyond. The project ELiTE aims to provide key answers to some of these fundamental questions. Astrobiology studies the origin, evolution and distribution of life in the Universe, starting with life on Earth, the only biological planet known so far. The ambitious objectives of the project ELiTE are the following: 1) The identification of Early traces of life and their preservation conditions, in Precambrian rocks of established age 2) The characterization of their biological affinities, using innovative approaches comprising micro to nanoscale morphological, ultrastructural and chemical analyses of fossil and recent analog material 3) The determination of the timing of major steps in evolution. In particular, the project ELiTE aims to decipher two major and inter-related steps in early life evolution and the rise of biological complexity: the evolution of cyanobacteria, responsible for Earth oxygenation and ancestor of the chloroplast, influencing drastically the evolution of life and the planet Earth, and the evolution of the domain Eucarya since LECA (Last Eucaryotic Universal Ancestor). 4) The determination of causes of observed pattern of evolution in relation with the environmental context (oxygenation, impacts, glaciations, tectonics, nutrient availability in changing ocean chemistry) and biological innovations and interactions (ecosystems evolution). Objective 1 has implications for the search for unambiguous traces of life on Earth and beyond Earth. Objectives 2 to 4 have implications for the understanding of causes and patterns of biological evolution and rise of complexity in Earth life. Providing answers to these most fundamental questions will have major impact on our understanding of early life evolution, with implications for the search for life beyond Earth.

**NBR: 308130** **ACRONYM: TERAMIX** **EC FUND: 1497775**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE9

**Title:** Study of Novel Low Noise Superconducting Mixers for Terahertz Radio Astronomy

**Abstract:** Terahertz heterodyne receivers are valuable tools for molecular gas spectroscopy both for space (radioastronomy, planetary science) and terrestrial applications. They provide both high resolution spectral data, as well as broad bandwidth line survey data. Due to the progress in device physics, such receivers can now reach several THz. At such high radio frequencies, neither electronic nor photonic approaches for THz detectors work, but rather a combination of both is required. Superconducting devices have proven to provide sensitivity levels close to the quantum limit, hf/k. Superconducting Hot- Electron Bolometers (HEB) based on ultrathin NbN and NbTiN films are currently the only devices which are used as mixers for frequencies above 1.2THz (SIS mixer limit). However, their speed (i.e. the instantaneous bandwidth) is limited by the finite electron energy relaxation rate, of 40-100 ps. It corresponds to the bandwidth of maximum 4-5GHz. Such applications in radio astronomy as extragalactic spectroscopy, molecular line survey require this bandwidth to be doubled to say at least. In this project we will investigate response rate in ultra thin MgB2 superconducting films. Preliminary investigation measured the electron-phonon interaction time as short as 1ps. Our recent data, point out on the response rate being limited by the phonon dynamic in the thick films. We will develop technology for ultrathin MgB2 film deposition, and processing THz nanobolometers. The response rate will be investigated with regards to the film parameters. In particularly, the phonon diffusion in superconducting nanobolometers will be studied in order to enhance the instantaneous bandwidth of MgB2 mixers. We estimate that the bandwidth of the novel THz detectors will be at least doubled compared to the existing once, providing completely new functionalities for THz radio astronomical receivers.

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**NBR: 308253** **ACRONYM: PACOMANEDIA** **EC FUND: 1245078**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE3

**Title:** Partially Coherent Many-Body Nonequilibrium Dynamics for Information Applications

**Abstract:** I propose to investigate two closely connected themes which aim to exploit the full potential of quantum mechanics in information technology. Both the themes concern the exploitation of the nonequilibrium dynamics of many strongly coupled quantum systems which is recently becoming feasible to observe in a plethora of engineered

systems. As one broad objective, I plan to examine automata made from a multiple quantum units such as nanomagnets for transporting bits and performing classical (Boolean) reversible logic. In a similar vein, coding of bits in domains of engineered quantum many-body systems and their exploitation for Boolean computing will be explored, as well as examine the quantum nonequilibrium dynamics of a processor which combines transport and processing together. The open nature of the constituent quantum systems will be an integral part of our calculations which will be set in a regime where dissipation (decay of energy from the system) is not significant, though dephasing (loss of quantum coherence) may be substantial. I foresee the advantage of such automata in highly energy efficient and fast computation whose speed is set by the couplings of the quantum many-body system. The second broad objective seeks to overcome a formidable obstacle in the physical implementation of quantum computation, namely the high control demanded on every quantum bit and their interactions with other quantum bits. I plan to offer and investigate an alternative paradigm where the information is processed by harnessing the minimally controlled dynamics of quantum many-body systems. In this context, I will look both at general questions such as to whether a network of interacting spins can serve as an automata for running an entire quantum algorithm, whether magnon wavepackets can be used like photons for linear optics-type quantum computation, as well as the realization of such ideas in a variety of available quantum many-body systems.

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**NBR: 308261** **ACRONYM: MORPHOSIS** **EC FUND: 1664600**

**DG:** ERCEA **Call: ERC-2012-StG_20111012** **Thema:** ERC-SG-PE8

**Title:** Morphing Locally and Globally Structures with Multiscale Intelligence by Mimicking Nature

**Abstract:** The objective of the proposed research is to engineer novel multifunctional morphing materials drawing inspiration from biological systems that are known to possess distributed sensing capabilities which in turn guide their local and global morphing. This will be achieved through the development of novel multi-scale technologies (nano- to macro) and materials that, once integrated, will allow distributed local/global sensing and morphing capabilities that can be exploited for structural as well as for eminently flexible applications. The distributed local/global morphing and sensing will be delivered by fabricating at the microscale a non-invasive, light-weight, flexible and highly expandable active network with enhanced actuation capabilities and a neurological sensor network. The networks are then expanded to the macro-scale prior being integrated in a flexible material or in an innovative multi-stable shape memory carbon-fiber composite. The sensor network has to monitor environmental and loading conditions. These data are then used to control the deformation of the active network which can deliver local (roughness changes as in dolphins skin for instance for drag reduction) or global morphing (e.g. for deformable textiles as in insect wings) in flexible

materials. The multi-stable carbon-fiber composite can be used in conjunction with these two functions so as to achieve advanced morphing in structural applications (e.g., birds wings vs. aircrafts wings). The composite, with a shape memory resin as hosting matrix, due to its rigidity and sensitivity to temperature variations, can snap from one configuration to the other. The speed of the purposefully-introduced snapping-through process will be tuned with the help of the integrated active network. This research has the potential to pave the way toward the development of new multidisciplinary research fields and could revolutionarize the design and production of future structures in a variety of fields.

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**NBR: 308391** **ACRONYM: DEROCA** **EC FUND: 2946150**

**DG:** RTD **Call: FP7-NMP-2012-SME-6** **Thema:** NMP.2012.2.2-5

**Title:** Development of safe and eco-friendly flame retardant materials based on CNT co-additives for commodity polymers

**Abstract:** Currently, best flame retardant formulations are still often based on halogenated flame retardants (FR). Those halogneted FR are supsected to endcrine disrupters when leaching from the material and produce toxic fumes and acids (HBr, HCl, organoirritants, PCDD/Fs etc.). DEROCA project aims at (i) developing and introducing new safer and more eco-friendly FRs through exploiting the synergistic effect of carbon nanotubes with phosphorus based flame retardants and other new promising additives in intumescent or carbon crust formation systems by promoting a more efficient/cost competitive solution; (ii) developing small scale test methods and models to predict full end product standard scale test results based on small scalte tests. The approach will be multifaceted: (i) to better understand and promote interactions between CNT and different (FR) additives; (ii) to develop FR applications for five final products which represent large volumes of commodity polymers, i.e. automotive industry, wire and cable, industrial packaging and foam; (iii) to demonstrate and to assess fire performance of end-products, including fire toxicity; (iv) to develop models for the prediction of fire classification of materials based on small scale tests; (v) to introduce small scale test methods and models developed into international standardization; (vi) to assess the mechanical and other product specific essential properties of the FR polymer; (vii) to assess toxcicity and environmental impact of the FRs developed both in the production chain and in the end use product; (ix) to assess the overall envrionmental impact of the Frs developed FRs through LCA.

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**NBR: 308439** **ACRONYM: NAWADES** **EC FUND: 3274701**

**DG:** RTD **Call: FP7-ENV-2012-two-stage** **Thema:** ENV.2012.6.3-1

**Title:** Nanotechnological Application in WAter DESalination

**Abstract:** The main objective of the NAWADES project is to study, design, produce, and test new water desalination filter technology from four points of view: 1. the structure of multi-layer membrane filter, including UV light distributed by glass fibers inside the membrane stack 2. the materials used to build the filter, including fouling and scaling monitoring 3. the coating treatments applied to the surface of the filter using plasma and nano-TiO2 fibers 4. the filtration process with integrated removal of bio-fouling. The new filter technology shall provide long-life and antifouling filters to be used in Reverse Osmosis (RO) water desalinisation processes with a higher efficiency and life-time, less energy consumption (lower pressure), and less maintenance (lower cost).

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**NBR: 308465** **ACRONYM: INNOBITE** **EC FUND: 3199730**

**DG:** RTD **Call: FP7-ENV-2012-two-stage** **Thema:** ENV.2012.6.3-1

**Title:** Transforming urban and agricultural residues into high performance biomaterials for green construction

**Abstract:** INNOBITE project will transform urban and agricultural residues into high performing resource efficient products for the construction sector. The project finds support in two innovative ideas: (1) adding value to the inorganic fraction of wheat straw and (2) obtaining cellulose nanofibres out of highly recycled paper. Once isolated via environmentally friendly processes, these two renewable compounds will be used as high-performance additives for the development of a new series of bio-composites The incorporation of those natural components will improve current solutions in two construction applications: panels for indoor structures (interior walls, ceiling, flooring…) and profiles (decking, fencing…) by, respectively, increasing the resistance-to-weight ratio and improving the surface hardness and water absorbency. Other commercial bio-plastics as well as the two major fractions of what straw, cellulose and lignin, will be also incorporated into such materials (cellulose after chemical modification and lignin after being polymerised into both thermosetting and thermoplastic resins), and the resulting products will be finally tested for biodegradability. In the same way as wood, which is at the same time biodegradable and exceptional building material, the use of plant-derived products will increase the biodegradability of the biomaterials without compromising their structural quality. The project will destine more than 10% of the total budget to maximize the effectiveness of the exploitation activities, which will include thorough analysis of the cost effectiveness and environmental credentials of the products/processes developed and of new possible business lines and new business models. Also, the validation of developed technologies under the Environmental Technology Verification programme is expected to have a big impact on the exploitation.

**NBR: 308850** **ACRONYM: INFERNOS** **EC FUND: 2294426**

**DG:** CNECT **Call: FP7-ICT-2011-C** **Thema:** ICT-2011.9.1

**Title:** Information, Fluctuations, and Energy Control in Small Systems

**Abstract:** Strong statistical fluctuations in meso- and nano-scale structures make their thermodynamic properties extremely dependent on the information available about them. The most basic process illustrating the importance of information to statistical systems is the information-to-energy conversion in the famous Maxwell's Demon (MD). Our primary goal is to study both experimentally and theoretically the statistics of fluctuations and the role of information in thermodynamics of the nano-scale systems. The first milestone will be the experimental realization of the nanoscale MD. We will create an experimental set-up and develop the corresponding theory of the monitored statistical evolution with feedback that optimizes the information-to-energy conversion. Our vision is to develop the nanoelectronic and bio-molecular devices that will allow us to systematically explore the limits of information-powered systems, in particular to test the Szilárd's limit relating one bit of information to extracted energy. We will also study statistics of energy fluctuations as revealed via equilibrium and non-equilibrium fluctuations of temperature. Part of these fluctuations has a quantum mechanical origin, but identification of this contribution in practice poses a challenging problem. Another novel extension of the MD work will be the study of thermodynamic constraints on quantum detectors. The principal novelty of our project is that it brings a rigorous experimental component to the field presently dominated by theory. Though the concept of a MD is tremendously important for development of modern statistical mechanics, MD-type experiments are still at their infancy. Our experimental study of MD will naturally lead to further progress in the relevant theoretical concepts.

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**NBR: 308997** **ACRONYM: NANOMATCELL** **EC FUND: 2722101**

**DG:** RTD **Call: FP7-ENERGY-2012-1-2STAGE** **Thema:** ENERGY.2012.10.2.1

**Title:** NOVEL ENVIRONMENTALLY FRIENDLY SOLUTION PROCESSED NANOMATERIALS FOR PANCHROMATIC SOLAR CELLS

**Abstract:** Dye-sensitized solar cell (DSSC) is the leading technology of third-generation solution-processed solar cells with reported efficiencies in excess of 10%. However despite the huge efforts in the last two decades saturation effects are observed in their performance. Efforts so far have been concentrated towards engineering and fine-tuning of the dyes, the electrolytes and the interface of the dye to the electron acceptor,

employing titania as the electron acceptor. DSSCs rely, then, on dyes for efficient light harvesting which in turn entails high fabrication costs associated to the Ru-based dyes as well as the use of 10 um thick devices. In addition, optimized titania requires high-temperature processing raising concerns for its potential for low-cost, flexible-platform fabrication. In this project we propose a disruptive approach; to replace titania with a novel electron accepting nanoporous semiconductor with a bandgap suitable for optimized solar harnessing and a very high absorption coefficient to allow total light absorption within 2 um across its absorption spectrum. In addition the deposition of the nanostructured platform will employ processing below 200oC, compatible with plastic, flexible substrates and cost-effective roll-to-roll manufacturing. We will focus on non-toxic high-abundance nanomaterials in order to enable successful deployment of DSSCs with targeted efficiencies in excess of 15% and 10% for SS-DSSCs, thanks to efficient solar harnessing offered by the novel nanocrystal electron acceptor. To tackle this multidisciplinary challenge we have assembled a group of experts in the respective fields: development of nanocrystal solar cells, DSSC technology and physics, atomic layer and surface characterisation and a technology leader (industrial partner) in the manufacturing and development of third generation, thin film, photovoltaic cells and modules (DSSCs).

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**NBR: 309018** **ACRONYM: ALLOXIDEPV** **EC FUND: 2999674**

**DG:** RTD **Call: FP7-ENERGY-2012-1-2STAGE** **Thema:** ENERGY.2012.10.2.1

**Title:** Novel Composite Oxides by Combinatorial Material Synthesis for Next Generation All-Oxide-Photovoltaics

**Abstract:** The global market for photovoltaic (PV) cells that are converting sunlight into electricity almost doubled in 2010 to reach a massive 18.2 GW, nearly three times size of the market back in 2008. Crystalline silicon is the most common PV material today with a market share of more than 80%. New developments such as electrolyte based dye-sensitized solar cells as well as organic polymer cells have experienced remarkable progress in the laboratory but penetration into the market is still far away due to stability and sealing problems. Thus, this project will develop all-oxide photovoltaic cells based on nano-composite materials using combinatorial synthesis methods in conjunction with large throughput characterization and computational data analysis. Oxides are chemically stable, many of them are not hazardous, abundant and can furthermore be produced by low-cost methods. To challenge the inherent limitations of pure oxide semiconductors novel composite materials consisting of two or more pure metal oxides using various mixing ratios will be developed. Moreover, new fabrication techniques, powerful characterization tools and computational analysis methods will be employed that have not been available yet for material science. Combinatorial synthesis methods used in biology, chemistry and pharmaceutical research will be adopted to screen efficiently through a large amount of oxide compositions.

**NBR: 309056** **ACRONYM: UPGRADE** **EC FUND: 999913**

**DG:** CNECT **Call: FP7-ICT-2011-C** **Thema:** ICT-2011.9.3

**Title:** bottom-UP blueprinting GRAphene baseD Electronics

**Abstract:** UPGRADE targets a fundamental breakthrough by achieving the first proof-of-concept of chemically controlled engineering of graphene nanoribbons (GNRs), through a novel and fast bottom-up patterning technique, which will enable the atomically-controlled fabrication of patterned GNRs over large areas. GNRs combine the advantages of graphene with the semiconducting properties required for the design of efficient field-effect transistors (FETs). The challenge here involves the development of an unconventional and innovative technology allowing for the fabrication of GNRs-based FET devices that feature reproducible and tailored electronic properties. In particular, the bottom-up approach is foreseen to provide graphene nanostructures with fully controlled physical, chemical and ultimately electronic properties at the atomic scale and should result in unprecedented graphene field-effect transistors characteristics. UPGRADE relies on a multidisciplinary and stepwise approach to integrate the work and expertise of young yet highly skilled researchers from complementary disciplines. The objectives will be achieved through five scientific work packages: i) Use of computation approaches including molecular mechanics/dynamics and quantum-chemical techniques to shed light on the process of self-assembly and electronic properties of the GNRs, as well as to provide theoretical support to the experimental results and design molecular architectures of interest; ii) Synthesis of functional building blocks; iii) Engineering of the graphene nanoribbons; iv) Multiscale physico-chemical quantitative studies of interfaces and hybrid nanostructures; v) Device fabrication and testing. The high risk nature of UPGRADE is offset by the potential breakthroughs that should emerge from the project in the field of ICT electronic devices and systems, thereby opening new R&D avenues for future technologies and strengthening Europe's global leadership in ICT.

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**NBR: 309127** **ACRONYM: PHOTONVOLTAICS** **EC FUND: 2894454**

**DG:** RTD **Call: FP7-ENERGY-2012-1-2STAGE** **Thema:** ENERGY.2012.10.2.1

**Title:** Nanophotonics for ultra-thin crystalline silicon photovoltaics

**Abstract:** The ambition of PhotoNvoltaics is to enable the development of a new and disruptive solar cell generation resulting from the marriage of crystalline-silicon photovoltaics (PV) with advanced light-trapping schemes from the field of nanophotonics. These two technologies will be allied through a third one, nanoimprint, an emerging lithography

technique from the field of microelectronics. The outcome of this alliance will be a nano-textured thin-film crystalline silicon (c-Si) cell featuring a drastic reduction in silicon consumption and a greater cell and module process simplicity. It will thus ally the sustainability and efficiency of crystalline silicon PV with the simplicity and low cost of the current thin-film solar cells. The challenge behind PhotoNvoltaics lies behind the successful identification and integration of these nano-textures into thin c-Si-based cells, which aim is a record boost of the light-collection efficiency of these cells, without harming their charge-collection efficiency. The goals of this project are scientific and technological. The scientific goal is two-fold: (1) to demonstrate that the so-called Yablonovitch limit of light trapping can be overcome, with specific nanoscale surface structures, periodic, random or pseudo-periodic, and (2) to answer the old question whether random or periodic patterns are best. The technological goal is also two-fold: (1) to fabricate thin c-Si solar cells with the highest current enhancement ever reached and (2) to demonstrate the up-scalability of this concept by fabricating patterns over industrially relevant areas. To reach these goals, PhotoNvoltaics will gather seven partners, expert in all the required fields to model and identify the optimal structures, fabricate them with a large span of techniques, integrate them into solar cells and, finally, assess the conditions of transferability of these novel concepts, that bring nanophotonics into PV, further towards industry.

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**NBR: 309129** **ACRONYM: I-RISC** **EC FUND: 1613284**

**DG:** CNECT **Call: FP7-ICT-2011-C** **Thema:** ICT-2011.9.1

**Title:** Innovative Reliable Chip Designs from Low-Powered Unreliable Components

**Abstract:** The ongoing miniaturization of data processing and storage devices and the imperative of low-energy consumption can only be sustained through low-powered components. Lower supply voltages and variations in technological process of emerging nanoelectronic devices make them inherently unreliable. As a consequence, the nanoscale integration of chips built out of unreliable components has emerged as one of the most critical challenges for the next-generation electronic circuit design. To make such nanoscale integration economically viable, new solutions for efficient and fault-tolerant data processing and storage must now be invented. The i-RISC project aims at achieving these goals, by providing innovative fault-tolerant solutions at both device- and system-level that are fundamentally rooted in mathematical models, algorithms, and techniques of information theory. Proposed solutions will build on error correcting codes and encoder/decoder architectures able to provide reliable error protection even if they themselves operate on unreliable hardware. The project will develop the scientific foundation and provide a first proof-of-concept by validating the proposed solutions on accurate error models and energy measurement tools developed within the project. In the forthcoming challenge of nanoscale technologies, the i-RISC project is an essential prerequisite for preparing the European industry for this paradigm shift.

**NBR: 309143** **ACRONYM: NEST** **EC FUND: 2356536**

**DG:** RTD **Call: FP7-ENERGY-2012-1-2STAGE** **Thema:** ENERGY.2012.10.2.1

**Title:** Nanowires for Energy STorage

**Abstract:** Among today challenges that of energy needs is one of the most important. An obvious question is its production but the need of energy storage systems is almost as large. Renewable energies will not have an impact unless we find an efficient way to store the electricity that they produce. Energy should be available everywhere and at any time, this translates in a strong need for energy containers in the form of electrochemical storage. In this context, the NEST project aims to demonstrate and develop a new kind of integrated supercapacitors, electrochemical capacitors (ECs), as well as novel pseudocapacitors devices able to drastically enhance the energy storage capacity. The primary target of the project is to produce a micro-supercapacitor with integrated electrodes compatible with microelectronics process that can withstand solder reflow (280°C for few minutes). We will associate the high surface area of a new kind of silicon nanostructures, to the high thermal stability of ionic liquids used as the electrolyte. We propose to integrate Si nanowires with sub-nanostructures such as silicon branches and nano-diamond coatings. Diamond coating will bring the additional advantage to allow using protonic electrolyte while keeping a wide 2-3 V electrochemical window. In addition to the giant surface area provided by the nanotree design, even higher capacitance will be achieved by using redox-active coating such as metal oxides and electro-conducting polymers (ECPs). As a result, this combination will lead to highly reversible surface redox reaction with electrochemical double layer capacitance. These new devices well adapted to peak power demand and storage while improving energy capacity will enhance the energy efficiency and consequently will increase the competitiveness of Europe's industries.

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**NBR: 309150** **ACRONYM: MERGING** **EC FUND: 2849654**

**DG:** RTD **Call: FP7-ENERGY-2012-1-2STAGE** **Thema:** ENERGY.2012.10.2.1

**Title:** Membrane-based phononic engineering for energy harvesting

**Abstract:** The aim of this proposal is to realise a compact thermoelectric module to harvest the energy of devices to be used in applications requiring heterogeneous integration packaging techniques leading to small size, integrability and high thermoelectric efficiency. Our concept, which goes up to a test device, is based on deep understanding of the behaviour of phonons, their control leading to the control of thermal transport. It

is based on minimizing the thermal conductance and or thermal conductivity by phonon engineering. A ZT=2.5 is targeted together with module compactness and integration potential. The module will be based on technologies combining Si microelectronics, thin film thermoelectric material and novel concepts to understand heat transport in 2-dimensional (2D) nanostructured materials such as Si-based ultrathin membranes, GeMn and strontium titanate. The device will carry enough current but insignificant or little heat. Theoretical and experimental investigations of heat transport will be carried out. The methods and technologies developed will enable nm-scale control of energy generation and heat flow. This will impact on on-chip and in-package energy management that is of crucial importance for future technologies. Especially, our targets contribute to (a) on-chip harvesting of thermoelectricity and (b) management of heat flow in the applications of heterogeneous integration and nanoelectronics.

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**NBR: 309194** **ACRONYM: GLOBASOL** **EC FUND: 2995040**

**DG:** RTD **Call: FP7-ENERGY-2012-1-2STAGE** **Thema:** ENERGY.2012.10.2.1

**Title:** Global solar spectrum harvesting through highly efficient photovoltaic and thermoelectric integrated cells

**Abstract:** GLOBASOL will develop new concepts, materials and devices for advanced light harvesting and light management for a panchromatic collection of the solar energy and an unprecedented power conversion efficiency. This will be accomplished by integrating in a single device three light-to-electricity converters, exploiting different regions of the solar spectrum based on sensitized mesoscopic solar cells (SMSC), photonic crystals, thermoelectric (TE) cells. The key elements of the project are: 1) new absorbers for SMSC, with a very high conversion efficiency in the UV-vis region; 2) novel photonic materials for the collection/split of the IR spectrum; 3) advanced nanostructured materials for TE conversion of the IR part of the spectrum; 4) radically new architectures for the integrated devices, to increase the total efficiency. The innovative materials will include organometallics, organic dyes and quantum dots as sensitizers, quasi-solid electrolytes, nanostructures and nanowires alloys as well as quantum dots for TE. The devices will be engineered either in tandem arrangements or with optical splitting of the incident radiation, and concentration of the IR fraction to the TE. The targeted power conversion efficiencies are above 15% and 10% for SMSC in high and medium energy spectral regions, respectively, and 6% for TE, to reach a global efficiency above 30%, well beyond the present limits, along with cost-effectiveness and environmental safety. Five Universities and one Research Institution guarantee a scientific and technological multidisciplinary research, based on top level theoretical and experimental approaches. The high degree of knowledge in solid-state physics and chemistry, nanoscience and nanotechnology and engineering of the researchers assures that the new concepts and the objectives proposed will be successfully developed/pursued. A high-tech SME will provide proof-of-concept prototypes to validate the innovative GLOBASOL devices.

**NBR: 309314** **ACRONYM: MODERN** **EC FUND: 999816**

**DG:** RTD **Call: FP7-NMP-2012-SMALL-6** **Thema:** NMP.2012.1.3-2

**Title:** MODeling the EnviRonmental and human health effects of Nanomaterials (MODERN)

**Abstract:** Nano-sized materials are a common element in many industrial processes mainly due to their unique properties that lead to the production of high technology products. The widespread use of nanotechnology requires the consideration of the environmental and human health risks that may result from the introduction of engineered nanoparticles (eNPs) into the environment. Although toxic effects for certain types of eNP have been recently reported, there is still a lack of knowledge about their possible long-term effects in biological systems. The project focuses on the understanding of the processes governing the interactions of nanoparticles with biological systems and their associated mechanisms of toxicity, which are essential for eNP safety assessment. Information on the effects of well characterized eNPs will be obtained from literature and other data repositories. Targeted in vivo and in vitro experiments will be also carried out to overcome the limitations of data availability and for model validation. Computational methods will be applied to model both nanostructure-property relationships and the complex and highly non-linear nano-bio interactions and to diminishing the need for animal testing. The main goal of MODERN is to establish new modeling approaches suitable for relating nanotoxicity with the intrinsic molecular and physicochemical properties of eNPs at environmental exposure levels and to implement safe-by-design nanoparticle design strategies. This implies three specific objectives: (i) To apply computational models for the characterization of the structural and physicochemical properties leading to QNPRs and safe-by-design strategies for eNPs; (ii) to develop in silico models (QNAR) of biological activity of eNPs in the body and in the environment; and (iii) to establish a categorization and hazard ranking protocol for eNPs based on structural similarity principles and in the analysis of their toxicological profiles.

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**NBR: 309495** **ACRONYM: NEONANO** **EC FUND: 1356000**

**DG:** ERCEA **Call: ERC-2012-StG_20111109** **Thema:** ERC-SG-LS7

**Title:** Neoadjuvant Nanomedicines for vascular Normalization

**Abstract:** The aim of my proposal is to establish 'Neoadjuvant Nanomedicines for vascular Normalization' (NeoNaNo) as a novel concept for improving the efficacy of combined modality anticancer therapy. This concept is radically different from all other drug targeting approaches evaluated to date, since nanomedicines are not used to directly

improve drug delivery to tumors, but to normalize the tumor vasculature, and to thereby indirectly improve drug (and oxygen) delivery. The need for such an alternative concept can be exemplified by taking the (pre-) clinical performance of nanomedicines into account: whereas in animal models, they generally improve both the efficacy and the tolerability of chemotherapeutic drugs, in patients, they often only attenuate the toxicity of the intervention, and they fail to improve the efficacy of the drug. To overcome this shortcoming, I here propose to use corticosteroid-containing nanomedicines, targeted to tumor-associated macrophages (TAM), to inhibit pro-inflammatory and pro-angiogenic signaling by TAM, and to thereby homogenize the tumor vasculature, increase tumor perfusion and reduce the interstitial fluid pressure. As a result of this, the tumor accumulation, intratumoral distribution and antitumor efficacy of subsequently administered chemotherapeutics, as well as of radiotherapy (because of enhanced oxygen delivery) can be substantially improved. To achieve these goals, liposomal, polymeric and micellar corticosteroids, several different animal models, and several different imaging agents and techniques will be used to (I) visualize and optimize nanomedicine-mediated vascular normalization; to (II) potentiate chemotherapy; and to (III) potentiate radiotherapy. These efforts will not only provide a solid basis for a completely new paradigm in nanomedicine research, but they will also result in novel, broadly applicable and clinically highly relevant combination regimens for improving the treatment of advanced solid malignancies.

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**NBR: 309517** **ACRONYM: NANOREM** **EC FUND: 10393632**

**DG:** RTD **Call: FP7-NMP-2012-LARGE-6** **Thema:** NMP.2012.1.2-1

**Title:** Taking Nanotechnological Remediation Processes from Lab Scale to End User Applications for the Restoration of a Clean Environment

**Abstract:** NANOREM is designed to unlock the potential of nanoremediation and so support both the appropriate use of nanotechnology in restoring land and aquifer resources and the development of the knowledge-based economy at a world leading level for the benefit of a wide range of users in the EU environmental sector. NANOREM uniquely takes a holistic approach to examining how the potential for nanoremediation can be developed and applied in practice, to enhance a stronger development of nanoremediation markets and applications in the EU. NANOREM's ambitious objectives are: 1) Identification of the most appropriate nanoremediation technological approaches to achieve a step change in practical remediation performance. Development of lower cost production techniques and production at commercially relevant scales, also for large scale applications. 2) Determination of the mobility and migration potential of nanoparticles in the subsurface, and their potential to cause harm, focusing on the NP types most likely to be adopted into practical use in the EU. 3) Development of a comprehensive tool box for field scale observation of nanoremediation performance and determination of the fate of NPs in the subsurface, including analytical methods,

field measurement devices, decision support and numerical tools. 4) Dissemination and dialogue with key stakeholder interests to ensure that research, development and demonstration meets end-user and regulatory requirements and information and knowledge is shared widely across the EU. 5) Provide applications at representative scales including field sites to validate cost, performance, and fate and transport findings. The NANOREM consortium is multidisciplinary, cross-sectoral and transnational. It includes 28 partners from 12 countries organized in 11 work packages. The consortium includes 18 of the leading nanoremediation research groups in the EU, 10 industry and service providers (8 SMEs) and one organisation with policy and regulatory interest.

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**NBR: 309518** **ACRONYM: NATURALE-POC** **EC FUND: 147918**

**DG:** ERCEA **Call: ERC-2011-PoC** **Thema:** ERC-OA-2011-PoC

**Title:** Bridging the gap in nanoparticle-based enzyme biosensing

**Abstract:** There is growing commercial interest in bio-responsive materials because of their many applications, such as in medical diagnostics at the point of care and in drug discovery and development. Our developed assay technologies manipulate the properties of gold nanoparticles and enzyme-based reactions to detect enzyme activity. Most diagnostics target either expressed antigens (immunodiagnostics) or DNA (molecular diagnostics). Our bio-responsive nanoparticle technology can offer a sensitive, specific and affordable platform for the development of rapid point-of-care tests based on simple colour readouts. Additionally one of the great advantages of our technology is the fact that, in addition to diagnosing disease, it can also potentially help in the search for new drugs to treat those diseases. In contrast to methods that simply measure enzyme concentration, our method actually measures enzyme activity. In this ERC POC our expected outcomes include a number of important commercial milestones and technical developments to expand the platform to other diseases and test its application in high throughput drug screening. This value will carry through in both licensing and spin-out, since these issues are fundamental to any business venture. Furthermore, we propose a balanced plan that includes technical research combined with commercial investigations and identification of appropriate industrial partners. At the conclusion of this work, we will be in a much stronger position to immediately commercialise this technology, bringing its benefits to the broader healthcare market.

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**NBR: 309530** **ACRONYM: PLIANT** **EC FUND: 9066110**

**DG:** RTD **Call: FP7-NMP-2012-LARGE-6** **Thema:** NMP.2012.1.4-1

**Title:** Process Line Implementation for Applied Surface Nanotechnologies

**Abstract:** In this proposed integrating project we will develop innovative in-line high throughput manufacturing technologies which are all based on atmospheric pressure (AP) vapour phase surface and on AP plasma processing technologies. Both approaches have significant potential for the precise synthesis of nano-structures with tailored properties, but their effective simultaneous combination is particularly promising. We propose to merge the unique potential of atmospheric pressure atomic layer deposition (AP-ALD), with nucleation and growth chemical vapour deposition (AP-CVD) with atmospheric pressure based plasma technologies e.g. for surface nano-structuring by growth control or chemical etching and, sub-nanoscale nucleation (seed) layers. The potential for cost advantages of such an approach, combined with the targeted innovation, make the technology capable of step changes in nano-manufacturing. Compatible with high volume and flexible multi-functionalisation, scale-up to pilot-lines will be a major objective. Pilot lines will establish equipment platforms which will be targeted for identified, and substantial potential applications, in three strategically significant industrial areas: (i) energy storage by high capacity batteries and hybridcapacitors with enhanced energy density, (ii) solar energy production and, (iii) energy efficient (lightweight) airplanes. A further aim is to develop process control concepts based on in-situ monitoring methods allowing direct correlation of synthesis parameters with nanomaterial structure and composition. Demonstration of the developed on-line monitoring tools in pilot lines is targeted. The integrating project targets a strategic contribution to establishing a European high value added nano-manufacturing industry. New, cost efficient production methods will improve quality of products in high market value segments in industries such as renewable energy production, energy storage, aeronautics, and space. DoW adaptations being made responding on requests from Phase-2 Evaluation Report In Phase-2 of the evaluation process, a number of points were noted by the evaluators where the project had insufficient information or could benefit from “upgrading” or justification. Our response and actions against each point raised has been summarized and send to the project officer, Dr. Rene Martins, in a separate document.

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**NBR: 309558** **ACRONYM: AIM4NP** **EC FUND: 3232637**

**DG:** RTD **Call: FP7-NMP-2012-SME-6** **Thema:** NMP.2012.1.4-3

**Title:** Automated in-line Metrology for Nanoscale Production

**Abstract:** Knowing the mechanical properties of workpieces and machine-tools also at the nanometer scale is an absolute necessity for an efficient nanoscale production. Current technologies are lacking the flexibility and robustness needed for measuring such key parameters as topography, morphology, roughness, adhesion, or micro- and nano-hardness directly in a production environment. This hinders rapid development cycles

and resource efficient process and quality control. The following technology and methodology gaps for addressing these challenges were identified: Efficient disturbance rejection and systems stability; robustness and longevity of probes; short time to data (i.e. high-speed measurements and data handling); and traceability of the measurement. The project aim4np strives at solving this problem by combining measuring techniques developed in nanoscience with novel control techniques from mechatronics and procedures from traceable metrology. Goal and Deliverable The main deliverable will be a fast robotic metrology platform and operational procedures for measuring with nanometer resolution and in a traceable way the topography, morphology, roughness, micro- and nano-hardness, and adhesive properties of large samples in a production environment.

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**NBR: 309596** **ACRONYM: NOVEL_MYOKINE** **EC FUND: 1999433**

**DG:** ERCEA **Call: ERC-2012-StG_20111109** **Thema:** ERC-SG-LS4

**Title:** Irisin - a novel myokine protective against metabolic disease

**Abstract:** Cardiovascular disease and diabetes constitute the major disease burden in the western world with growing morbidity. Exercise is known to ameliorate many of the key processes in the pathogenesis of these diseases, but the underlying mechanism is not clear. Especially little is known about how exercise affects non-muscle tissues such as the heart, fat and liver. Knowledge of such pathways could lead to new therapeutic possibilities for diabetes and cardiovascular diseases. I have recently discovered a new hormone, named Irisin. Irisin is regulated by PGC1α, secreted from muscle to plasma after exercise and promotes the formation of brown fat via an unknown receptor. Furthermore, irisin is 100% conserved between mice and humans at the amino acid level (89% identity between zebfrafish and human). Nanomolar levels of this protein increase uncoupling protein 1 (UCP1) in cultures of primary white fat cells by 50 fold or more, resulting in very large increases in uncoupled respiration. Perhaps more remarkable, in vivo delivery of irisin stimulates a robust increase in UCP1, increased energy expenditure and reversal of type II diabetes in high fat fed mice. It is thus likely that irisin is responsible for at least some of the beneficial effects of exercise on the browning of adipose tissues and increases in energy expenditure. The therapeutic potential of irisin is obvious; it is a conserved endogenous polypeptide, induced with exercise and with powerful anti-diabetic properties. Irisin could, for example, be administered exogenously, or the secretion of irisin could be enhanced. These approaches, however, require additional studies, and my aim in this project is to advance the knowledge around irisin for future therapeutic testing. Given success of the ERC grant application, I will move from Harvard/Boston 2012 and start my lab at the department of Cell- and Molecular Biology, Karolinska Institute, Sweden. As seen in my list of publication, Im well prepared for this task

**NBR: 309636** **ACRONYM: 4G-PHOTOCAT** **EC FUND: 3727767**

**DG:** RTD **Call: FP7-NMP-2012-SMALL-6** **Thema:** NMP.2012.2.2-6

**Title:** Fourth generation photocatalysts: nano-engineered composites for water decontamination in low-cost paintable photoreactors

**Abstract:** The project 4G-PHOTOCAT allies the expertise of 7 academic and 3 industrial partners from 5 EU countries (Germany, United Kingdom, Czech Republic, Poland, and Finland) and 2 ASEAN countries (Malaysia and Vietnam) for the development of a novel generation of low-cost nano-engineered photocatalysts for sunlight-driven water depollution. Through rational design of composites in which the solar light-absorbing semiconductors are coupled to nanostructured redox co-catalysts based on abundant elements, the recombination of photogenerated charges will be suppressed and the rate of photocatalytic reactions will be maximized. In order to achieve fabrication of optimal architectures, advanced chemical deposition techniques with a high degree of control over composition and morphology will be employed and further developed. Furthermore, novel protocols will be developed for the implementation of the photocatalysts into a liquid paint, allowing for the deposition of robust photoactive layers onto flat surfaces, without compromising the photoactivity of immobilized photocatalysts. Such paintable photoreactors are envisaged particularly as low-cost devices for detoxification of water from highly toxic persistent organic pollutants which represent a serious health issue in many remote rural areas of Vietnam and other countries. The 4G-PHOTOCAT project will provide novel scientific insights into the correlation between compositional/structural properties and photocatalytic reaction rates under sunlight irradiation, as well as improved fabrication methods and enhanced product portfolio for the industrial partners. Finally, 4G-PHOTOCAT will lead to intensified collaboration between scientists working at the cutting edge of synthetic chemistry, materials science, heterogeneous photocatalysis, theoretical modelling, and environmental analytics, as well as to unique reinforcement of cooperation between scientists and industry partners from EU and ASEAN countries.

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**NBR: 309666** **ACRONYM: PRENANOTOX** **EC FUND: 997734**

**DG:** RTD **Call: FP7-NMP-2012-SMALL-6** **Thema:** NMP.2012.1.3-2

**Title:** Predictive toxicology of engineered nanoparticles

**Abstract:** The production of many consumer products based on manufactured NanoParticles (NPs) has led to a growing public and regulatory concern about the safety of nanomaterials.

Since experimental toxicological testing of NPs, especially in vivo animal studies is costly and time-consuming, it is necessary to develop a novel research field and associated methods and tools to reach the goal of predictive nanotoxicology. The PreNanoTox consortium addresses three currently missing critical elements needed to develop a platform for predictive nanotoxicology and our suggested approach of providing them: (1) There is a current lack of unified large database – We suggest to form this database by applying cutting edge information extraction tools on large repository of scientific articles; (2) There is a need for better understanding the underlying mechanisms of the primary interaction of NP with the cell membrane – We suggest to apply appropriate theory and simulation assuming that the surface chemistry of a NP (affecting NP's surface reactivity, hydrophobicity, or surface electrostatics) as well as its other physical properties (e.g. size and shape) determine the strength of the non-specific adsorption of NPs to a cell surface, leading beyond a certain adhesion-strength threshold, to efficient uptake of the NPs; (3) There is a need to extend the traditional QSAR paradigm to the field of nanotoxicology – This will be carried out by linking appropriate NP descriptors, with emphasis on those which determine the strength of adsorption of NPs to cells, with biological responses. The PreNanoTox consortium is made up of four research groups (from three scientific organizations), which lead in information technology, soft matter modeling, computational chemistry and in-vitro toxicology, yielding a synergetic output. This project will assist in safe designing of new engineered NPs as well as reducing tha extent needed for empirical testing of toxicity.

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**NBR: 309672** **ACRONYM: NEMI** **EC FUND: 3731488**

**DG:** RTD **Call: FP7-NMP-2012-SME-6** **Thema:** NMP.2012.1.4-3

**Title:** Scanning Neutral Helium Microscopy: A novel tool for fast, nondestuctive characterisation of mechanical parameters for nanostructured coatings

**Abstract:** The majority of failures in pattern replication processes are caused by wear of forming and forging master tools. Tribology is the science applied for lowering the wear by developing advanced (nanostructured) coatings. However, even these coatings are subject to wear that manifest itself as changes in the mechanical properties of the master tool in the form of fractures, roughness changes (adhesion) or deformation of the 3D shape. Hence a careful examination of the surface structure is essential for validating the functionality of a master tool. Ideally by applying a fast, reliable measurement, which determines the first wear before any faulty replication takes place. No such method exists at present for nanoscale structures: Scanning probe microscopy is generally slow and not suitable for the high aspect ratio structures often present in forming and forging tools. Scanning electron and helium ion microscopy offer alternatives. However both beams penetrate into the material which limits the accuracy, the beam energy can cause surface damage and there may be image distortions due to charging effects. Here we propose a new instrument based on NEUTRAL helium atoms.

The technique is strictly surface sensitive with no penetration into the bulk (the atoms interact with the outermost electronic layer on the surface). The energy of the atoms is less than 0.1 eV, 4-6 order of magnitudes less than typical electron and helium ion energies. The new technique can image down to 10 nm and has the potential of being fast and applicable over large areas. We will apply the new technique to access the tool lifetime improvement by the application of nanostructured coatings to micron and nanometer precision master tools from SME partners Kenneth Winther A/S and NILTechnology. Metrology partners DFM and KTH will evaluate the new instrument in relation to ISO-standard parameters with the aim of introducing the technique to the ISO TC213/WG16 committee for future standardization.

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**NBR: 309741** **ACRONYM: DECORE** **EC FUND: 2341664**

**DG:** RTD **Call: FP7-NMP-2012-SMALL-6** **Thema:** NMP.2012.1.1-1

**Title:** Direct ElectroChemical Oxidation Reaction of Ethanol: optimization of the catalyst/support assembly for high temperature operation (DECORE)

**Abstract:** The main general goal of DECORE is to achieve the fundamental knowledge needed for the development of a fuel cell (FC) electrode, which can operate efficiently (both in terms of activity and selectivity) as the anode of a direct ethanol (EOH) FC (DEFC) in the temperature range between 150-200 °C (intermediate-T). Such a technology is still lacking in the market. The choice for EOH as an alternative energy source is well founded on the abundance of bioethanol, and on the relatively simpler storage and use with respect to other energy carriers. The intermediate-T is required for an efficient and selective total conversion of EOH to CO2, so exploiting the maximum number of electrons in the DEFC. DECORE will explore the use of fully innovative supports (based on titanium oxycarbide, TiOxCy) and nano-catalysts (based on group 6 metal carbides, MCx, M=Mo,W), which have never been tested in literature as anodes for DEFCs. The new support is expected to be more durable than standard carbon supports at the targeted temperature. The innovative nano-catalysts would be noble-metal free, so reducing Europe's reliance on imported precious metals. To tailor the needed materials, the active role of the support and nano-catalyst will be studied at atomic level. Demonstrating an activity of such nano-catalyst/support assembly at intermediate-T would open a novel route where DEFCs with strongly reduced production costs would have an impact on a fast industrialisation. The power range for the envisioned application is of the order of hundreds of Watts, i.e. the so called distributed generation, having an impact for devices such as weather stations, medical devices, signal units, auxiliary power units, gas sensors and security cameras. By the end of the project, a bench-top single DEFC operating at intermediate-T will be built and tested.

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**NBR: 309786** **ACRONYM: DEVICE** **EC FUND: 147744**

**DG:** ERCEA **Call: ERC-2011-PoC** **Thema:** ERC-OA-2011-PoC

**Title:** Taking in-situ controlled nanomaterials manufacturing to market

**Abstract:** Applications of nanomaterials are based on concepts relying on the structural control of materials at the nanometre scale because at the nanometre scale properties denied to larger, bulk objects can be unlocked. However, technologies based on nanomaterials will only be successful if we are able to systematically control production processes and nanomaterials' morphologies. Hence, in the last 20 years much effort was dedicated towards understanding nanomaterials' formation and scaling-up production techniques from a laboratory to industrial scale. Yet, there are still many technical barriers preventing further progress in this area of research. These include the in-situ control of production processes employed for the generation of dedicated nanomaterials possessing tailored properties. We have followed a multidisciplinary approach of existing knowledge in nano-scale processing combined with state-of-the-art production techniques, and in-situ characterisation techniques, to create more efficient nanomaterials manufacturing techniques suitable for up-scaling. For this we have developed a prototype in-situ online control system which we have filed for a patent and aim to bring to market. With the ERC PoC we plan to carry out detailed analysis and develop a refined system suitable for an even wider range of industrial partners. Bringing such device together with an integrated approach will enable new applications of dedicated nanomaterials to be developed in the fields of energy saving and nano-composite materials in aerospace or medical applications.

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**NBR: 309820** **ACRONYM: NANOATHERO** **EC FUND: 9833348**

**DG:** RTD **Call: FP7-NMP-2012-LARGE-6** **Thema:** NMP.2012.1.2-2

**Title:** Nanomedicine for target-specific imaging and treatment of atherosclerosis: development and initial clinical feasibility

**Abstract:** NanoAthero aims to have demonstration of initial clinical feasibility of nanosystems for targeted imaging and treatment of advanced atherosclerotic disease in humans. The nanosystems are assemblies of following components: nanocarrier, targeting, imaging agent/drug. They have proven safety records, and strong preliminary in vitro and in vivo proofs of efficacy are available. Partners have patented and provided evidence of efficacy of carriers and ligands. Over 5 years, NanoAthero will integrate GMP production, the initiation of clinical investigations in high-risk patients, including the preparation of regulatory dossiers, risk and ethical assessments, and the evaluation of the performance of optimized diagnostic and therapeutic compounds. NanoAthero

offers a unique opportunity for combining in-depth knowledge of nanocarrier bioengineering and production with state-of the art expertise in imaging and treatment of cardiovascular patients providing a full bench-to-bedside framework within one collaborative consortium of 16 partners from academia, a European association, SMEs and a large pharmaceutical company. NanoAthero gathers together leading chemists, engineers, pharmacists, biologists, toxicologists, clinicians, analysts, ethicists and key-opinion leaders in the field of cardiovascular medicine and early drug development. In NanoAthero, the nanocarriers carrying compounds to visualize thrombus or vulnerable plaques, or to deliver therapeutic agents should be suitable for proof-of-concept in patients. Phase I clinical trials targeting pivotal pathways in atherothrombosis will be performed with nanosystems for diagnosis and treatment of carotid atheroma. NanoAthero aims to propose nanosystems for thrombus imaging, stroke treatment and plaque stabilization in high-risk patients. Molecular imaging and therapeutic treatments in NanoAthero are based on feasible approaches.

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**NBR: 309837** **ACRONYM: NANOPUZZLES** **EC FUND: 976810**

**DG:** RTD **Call: FP7-NMP-2012-SMALL-6** **Thema:** NMP.2012.1.3-2

**Title:** Modelling properties, interactions, toxicity and environmental behaviour of engineered nanoparticles

**Abstract:** Nanotechnology is rapidly expanding. However, some types of engineered nanoparticles can be toxic for living organisms and exhibit negative impact on the environment. Thus, the design of new nanomaterials must be supported by a rigorous risk analysis. Following the recommendations by the EU REACH system and regarding ethical aspects, the risk assessment procedures should be performed with possible reduction of living animal use. The main objective of the NanoPuzzles project is to create new computational methods for comprehensive modelling the relationships between the structure, properties, molecular interactions and toxicity of engineered nanoparticles. The methods will be based on the Quantitative Structure - Activity Relationship approach, chemical category formation and read-across techniques. Those methods have been widely used in risk assessment of other groups of priority chemicals. But, because of some specific reasons, they can not be applied directly to nanoparticles. We will be developing novel methods within four complimentary areas ("puzzles"), namely: (i) evaluation of physico-chemical and toxicological data available for nanoparticles (NanoDATA), (ii) developing novel descriptors of nanoparticles' structure (NanoDESC), (iii) investigating interactions of nanoparticles with biological systems (NanoINTER), and (iv) quantitative structure - activity relationships modelling (NanoQSAR). Developed methods will be tested and verified for their technical viability by the collaborating industry representative. By implementing the NanoPuzzles methods, extensive animal testing would be significantly reduced. Moreover, the project will deliver the basis for categorising nanoparticles based on potential exposure, phys-chem, structural and

toxicological properties. To maximise its impact, the project is going to cooperate with ModNanoTox, NanoTransKinetics, NanoSafety Cluster and NanoMedicine ETP.

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**NBR: 309980** **ACRONYM: CARERAMM** **EC FUND: 2641860**

**DG:** RTD **Call: FP7-NMP-2012-SMALL-6** **Thema:** NMP.2012.2.2-2

**Title:** Carbon resistive random access memory materials

**Abstract:** Carbon offers an exciting route to the realisation of future generations of high-performance, cost-effective, environmentally-friendly, resistive-switching type non-volatile data storage. Scalability to the molecular level, sub-nanosecond switching time, ultra-low power operation, environmental stability, environmental friendliness, simple memory structures, advanced functionality and cost-effectiveness are all features readily provided by carbon-based data storage materials. CareRAMM will develop advanced carbon-based resistive switching materials, specifically sp3-rich a-C and graphene-oxide (GO) films, for next generation non-volatile data storage applications. Our aims are: (i) To fabricate and characterise a-C and GO films for resistive memory applications (ii) To determine the precise nature and origin of resistive switching in such a-C and GO films (iii) To determine the ultimate scalability - dimensionally, temporally and in terms of energy - of such resistive switching (iv) To determine the expected limits of endurance, lifetime and operating temperatures. We will also pursue entirely new materials concepts that potentially offer enhanced performance, in particular 'all carbon' materials combinations and structures (e.g. graphene/a-C/graphene). Measurable project objectives include: (i) sub-nanosecond switching times (ii) sub-10 nm feature size (iii) sub-10 µW write power (~ pJ write energy) (iv) predicted lifetime of at least 10 years at 100C for consumer applications (v) predicted lifetime of at least 10 years at 200C for automotive, aerospace and military applications (vi) demonstration of multi-level storage capability (vii) demonstration of memristive-like functionality (viii) demonstration of suitability of GO-materials for flexible memories. To realise our objectives we bring together academic and industrial partners with internationally leading expertise covering all aspects of the proposed work.

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**NBR: 310034** **ACRONYM: INTERACT-MEMNP** **EC FUND: 1483486**

**DG:** ERCEA **Call: ERC-2012-StG_20111109** **Thema:** ERC-SG-LS9

**Title:** Interaction and actuation of lipid membranes with magnetic nanoparticles

**Abstract:** Cell membranes contain a large part of the delicate machinery of life and comprise the barriers controlling access to and from the interior of the cell. With the increasing use of

nanoparticles (NPs) in medical imaging, drug delivery, cosmetics and materials the need is great and increasing to understand how NPs physically interact with cell membranes. On the one hand it is important to understand mechanisms to control risks of novel nanomaterials and to design therapeutic agents which can enter cells specifically and non-destructively. On the other hand, the structure and function of biological membranes inspire development of biomimetic smart materials for biotechnological applications which exploit or are modeled on biological membranes, but given enhanced functionality and external control of properties through incorporation of functional NPs. The aim of the proposed work is to develop understanding of the biophysical interaction of functional NPs with lipid membranes, in particular NP incorporation into and penetration through lipid membranes. Further, the aim is, based on that knowledge, to understand and control the self-assembly of superparamagnetic NPs into synthetic and cell lipid membranes to actuate them and control their physical properties in pursuit of novel biomimetic smart materials and cell analytical methods. The required level of control for this research has until recently been beyond the reach of existing NP systems (lack of synthetic control, stability and characterization) and methodology (lipid membrane models and high resolution techniques for their investigation). However, it can now be achieved using the Fe3O4 NP platform and surface-based and vesicular membrane model systems of tuned composition that I have developed. Using the same platform, breakthrough magneto-responsive biomimetic smart materials with application in drug delivery and cell manipulation with novel mechanisms of actuation will be self-assembled and investigated.

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**NBR: 310105** **ACRONYM: MULTICHIP** **EC FUND: 150000**

**DG:** ERCEA **Call: ERC-2011-PoC** **Thema:** ERC-OA-2011-PoC

**Title:** Explore the potentialities of multi-print chips for diagnostic research

**Abstract:** MULTICHIP production of a multiplexed microarrays provides an exciting business opportunity. MULTICHIP offers unique advantages in areas of large societal importance, such as public health, and environmental safety. Multiplexed microarrays, i.e. arrays with a high number of different biomolecules, are attractive for rapid screening such as early detection of cancer and farm animal diseases, and multitoxin screening of ecosystems. Conventional array production methods lack in quality or multiplexing abilities. Moreover, technologies like dip-pen nanolithography require intensive training of personnel, which seriously limits the potential user groups. MULTICHIP enables easy, cheap production of multiplexed arrays by stamping biomolecules. Extensive re-use ( up to 75 times) of stamps is possible and MULTICHIP can be used to stamp a wide range (10 kDa – 1 MDa) of biomolecules. MULTICHIP can also stamp on soft surfaces, which is of particular importance for tissue engineering, and reconstructive medicine. These factors greatly enhance application potential. Stamping techniques have been suggested earlier, but as hydrogels are used for storage of biomolecules in the stamp reservoirs, lifetime,

re-use capability (maximum 4-5 times), and range of biomolecules (maximum 150 kDa) that can be stamped are extremely limited. Stamping is only feasible on hard surfaces. In MULTICHIP innovative, robust macroporous polymeric networks are used for biomolecules storage, creating a breakthrough in multiplexed microarray production. In this project, a business case will be developed for MULTICHIP, covering different markets, and routes for market introduction. Results of market analysis (market size and segmentation, expected sales and financing needs) will be combined with science-based technology comparison into comprehensive documentation for discussion with potential industry partners. Several industries already have expressed their interest in MULTICHIP.

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**NBR: 310177** **ACRONYM: LIMPID** **EC FUND: 3299469**

**DG:** RTD **Call: FP7-NMP-2012-SMALL-6** **Thema:** NMP.2012.2.2-6

**Title:** Nanocomposite materials for photocatalytic degradation of pollutants

**Abstract:** Limpid aims at generating new knowledge on photocatalytic materials and processes in order to develop novel depollution treatments with enhanced efficiency and applicability. The main goal of LIMPID is to develop materials and technologies based on the synergic combination of different types of nanoparticles (NPs) into a polymer host to generate innovative nanocomposites which can be actively applied to the catalytic degradation of pollutants and bacteria, both in air or in aqueous solution. Single component nanocomposites including TiO2 NPs are already known for their photocatalytic activities. LIMPID will aim at going one big step further and include, into one nanocomposite material, oxide NPs and metal NPs in order to increase the photocatalytic efficiency and allow the use of solar energy to activate the process. One of the main challenge of LIMPID is to design host polymers, such as hybrid organic inorganic and fluorinated polymers, since photocatalysts can destroy the organic materials. The incorporation of NPs in polymers will allow to make available the peculiar nano-object properties and to merge the distinct components into a new original class of catalysts. At the same time nanocomposite formulation will also prevent NPs to leach into water and air phase, thus strongly limiting the potential threat associated to dispersion of NPs into the environment. Therefore nanocomposites developed in LIMPID will be used as coating materials and products for the catalytic degradation of pollutants and bacteria in water and air, i.e. deposited onto re-usable micro-particles, or in pollutant degradation reactors, and even onto large surfaces, as a coating or paint. In addition such new class of nanocomposites will be also exploited for the fabrication of porous membranes for water treatment. In order to fulfill its objectives, the LIMPID consortium has been designed to combine leading industrial partners with research groups from Europe, ASEAN Countries and Canada.

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**NBR: 310184** **ACRONYM: CARINHYPH** **EC FUND: 2885910**

**DG:** RTD **Call: FP7-NMP-2012-SMALL-6** **Thema:** NMP.2012.1.4-2

**Title:** Bottom-up fabrication of nano carbon-inorganic hybrid materials for photocatalytic hydrogen production

**Abstract:** This projects deals with the hierarchical assembly of functional nanomaterials into novel nanocarbon-inorganic hybrid structures for energy generation by photocatalyic hydrogen production, with carbon nanotubes (CNTs) and graphene the choice of nanocarbons. The scientific activities include the development of new functionalisation strategies targeted at improving charge transfer in hybrids and therefore their photocatalytic activity, and in transferring these synergistic effects by assembling the hybrid units into macroscopic structures. Three different types of hybrid architectures will be explored: Hybrids 1 – consisting of inorganic gyroids impregnated with the nanocarbon; Hybrid 2 – consisting of nanocarbon membranes coated with the inorganic compound by atomic layer deposition; Hybrid 3 - electrospun hybrid fibres. We specifically aim to tailor interfacial charge and energy transfer processes by means of chemical functionalisation and evaluate them with photochemical and transient spectroscopy, as well as explore the effect of the nanocarbon as a substrate and heat sink, which stabilises smaller semiconductor particles and reduces agglomeration that will result in larger accessible surface areas. Two industrial partners in the consortium, a nanocarbon supplier and a potential end user, guarantee that both ends of the production line are taken into account for the development of new technologies and the production of a roadmap for industrial deployment. This roadmap will also measure sustainability of processes and materials developed in this project in terms of environmental and economical impact as compared to state-of-the-art techniques for the production of hydrogen by the use of adequate Life Cycle Costing (LCC) and Life Cycle Assessment (LCA) approaches.

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**NBR: 310187** **ACRONYM: PHOENIX** **EC FUND: 5099936**

**DG:** RTD **Call: FP7-NMP-2012-SME-6** **Thema:** NMP.2012.2.2-5

**Title:** Synergic combination of high performance flame retardant based on nano-layered hybrid particles as real alternative to halogen based flame retardant additives

**Abstract:** Electrical and electronic (EE) applications – including housings, wire and cable, and internals such as connectors– are the largest market for flame retardants (FR) in plastics globally. The need for flame retardancy is increasing due to electronics miniaturization and higher temperatures in both processing and use. PHOENIX project is an ambitious multidisciplinary innovative threefold approach to develop: (i) A new concept of FR

nanostructured materials, based on new non-halogenated flame-retardants applying nanotechnology to replace hazardous chemicals to produce sustainable FR additives based on nanolayered structures and modified lignins, produced with innovative and green chemical routes, for thermoplastic and thermoset applications. (ii) Innovative processing routes, providing solutions to the demands of the EU Industry regarding FR, finding a true cost-effective and sustainable alternative to existing non-environmentally friendly HFR, which allows simultaneously a significant improvement of mechanical properties and processability, highly limited with the existing non-halogenated FR available in the market for compounding, extrusion and injection moulding processes. New compounding techniques such as Nanodirekt process, and high innovative systems, such as ultrasounds mixing systems coupled to extrusion and injection equipments, will assure high nanoparticles dispersion in the polymer nanocomposites and in the final pieces, thus achieving optimal properties. (iii) Simulation and modelling of compounding processes for the preparation of optimal nanocomposites, avoiding aggregates and achieving the best dispersion of the nanoparticles in the polymer matrix. The achievement of these results will represent a significant advantage to the participating SMEs and in turn to the End-Users demanding high-performance environmentally friendly FR materials to manufacture high-performance parts.

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**NBR: 310191** **ACRONYM: CHIPCAT** **EC FUND: 3675906**

**DG:** RTD **Call: FP7-NMP-2012-SMALL-6** **Thema:** NMP.2012.1.1-1

**Title:** Design of Thin-Film Nanocatalysts for On-Chip Fuel Cell Technology

**Abstract:** chipCAT aims at the knowledge-driven development of a novel type of thin-film catalysts for silicon-based “on-chip” micro fuel cells (u-FCs). Combining fundamental surface-science, model catalysis, and first-principles computational studies, a detailed understanding of the surface chemistry on complex nanostructured catalysts will be achieved. This microscopic-level understanding will be used to tailor active sites and their mutual interplay at the nanoscale in order to maximize activity and selectivity and to reduce deactivation and poisoning. Starting from new oxide-based materials with minor demand for noble metals, new material concepts will be explored. Target structures defined by fundamental research will then by transferred to standard FC and u-FC catalysis by using advanced thin-film preparation techniques, such as magnetron sputtering and vacuum deposition. Knowledge-transfer between real and model catalysis will be guaranteed with atomic-level control, using a broad spectrum of surface spectroscopies, in-situ/operando spectroscopies, and microscopies with atomic resolution. Using modern microtechnologies, the novel tailor-made catalyst materials will be integrated into working FC test devices. Prototype devices will be fabricated for performance tests with results fed back to fundamental research. Finally, a process for laboratory-scale production of u-FC batches will be developed. Thus, we will connect surface science, model catalysis, state-of-the-art theory, thin-film-technology, applied

heterogeneous catalysis, and microtechnology in an interdisciplinary approach, aiming at the development of a new generation of metal-oxide FC catalysts with improved performance and stability. This project not only will allow to drastically reduce or replace usage of critical materials in the related applications but also will open the pathway to groundbreaking energy storage technologies for mobile devices.

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**NBR: 310229** **ACRONYM: SMARTONICS** **EC FUND: 7987000**

**DG:** RTD **Call: FP7-NMP-2012-LARGE-6** **Thema:** NMP.2012.1.4-1

**Title:** Development of smart machines, tools and processes for the precision synthesis of nanomaterials with tailored properties for Organic Electronics

**Abstract:** The target of the Smartonics project is the development of Pilot lines that will combine smart technologies with smart nanomaterials for the precision synthesis of Organic Electronic (OE) devices. The Smartonics objectives are: 1.Development of smart Nanomaterials for OEs (polymer & small molecule films, plasmonic NPs and super-barriers) by process and computational modeling optimization. 2.Development of smart Technologies (r2r printing and OVPD machines combined with precision sensing & laser tools and processes). 3.Integration of Nanomaterials & Technologies in Pilot lines for precision synthesis of Nanomaterials & OE devices, optimization, demonstration and evaluation for Industrial applications. Smartonics will develop three Pilot lines: a) OVPD Pilot line equipped with in-line optical sensing tools, b) r2r printing Pilot line, which will combine optical sensing and laser processing tools, and c) s2s Pilot line for the precision fabrication of OE devices (e.g. OLEDs, sensors from state-of-the-art Nanomaterials) and for the evaluation of encapsulation of these devices. The above will be up-scaled in Industrial processes. More specifically: - The parameters for small molecule OPVs will be up-scaled to Industrial scale OVPD machine. - The process parameters for r2r OPVs will be up-scaled and demonstrated in r2r printing machines. - The advances and precision in the synthesis of nanomaterials by the optical sensing tool will be evaluated for flexible displays. - The advances for the r2r printing process will be evaluated for large-scale production of OPVs. - The flexible OPVs will be validated and implemented in automotives applications. All the above are consistent with the topic NMP.2012.1.4-1 since the the targets of project are including the development of Pilot lines that will be combined with production machines (gas (transport and printing), precision and fabrication tools and processes for the precision synthesis of Nanomaterials and OEs.

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**NBR: 310250** **ACRONYM: UNION** **EC FUND: 3798053**

**DG:** RTD **Call: FP7-NMP-2012-SMALL-6** **Thema:** NMP.2012.1.4-2

**Title:** Ultra-versatile Nanoparticle Integration into Organized Nanoclusters

**Abstract:** UNION will develop nanoparticle (NP) assembly techniques, and assembly monitoring technologies to prepare novel hierarchically-ordered nanoparticle clusters (NPCs). By improving control over the synthesis and assembly of NPs we will produce materials with tailored and predictable properties. Furthermore, by incorporating hierarchical control into the assembly (through the type, size and spatial distribution of the NPs) it will be possible to assess the influence of the hierarchy on properties and develop new functionalities. UNION will investigate how the emergent properties of the assemblies are determined by the architecture of the assembly, the extent of order, and the properties of the component NPs. This will enable tuning of the primary NP properties and the assembly processes to develop significant breakthroughs in nano-devices and next generation complex nanotechnology products. As the ultimate aim is commercial exploitation of our results, in each stage of the development process we will use application driven, scalable and cost-effective processes, incorporating EHS assessment and roadmap preparation towards future industrial deployment. UNION will achieve its objectives through a three stage approach. - Improved NP preparation providing optimised surface chemistry for subsequent assembly - Novel NPC formation (hierarchical nanoparticle assembly) methods - Roll-out of NPCs for three application areas NPC applications will be developed within three core areas corresponding to the different hierarchical structural levels; in suspensions of individual NPCs (biomedical), in supported 2D NPC arrays (optical), and in 3D arrays or nanocomposites (thermoelectric). Our consortium is comprised of multidisciplinary research groups involving 8 partners with ex-pertise in preparation and application of nano-materials. It includes significant industrial participation with 4 companies with specific knowledge and testing capability for the target application areas.

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**NBR: 310275** **ACRONYM: BIONLIGHT** **EC FUND: 149990**

**DG:** ERCEA **Call: ERC-2011-PoC** **Thema:** ERC-OA-2011-PoC

**Title:** Targeting the biological imaging market with multifunctional fluorescent nanoparticles

**Abstract:** BioNLight has been designed to investigate the prospective of commercially exploiting our multimodal nanoparticle technology in the biological imaging market. The introduction of this technology will open up an entirely-new window of molecular imaging possibilities, thereby supporting advances in biology, drug discovery & development and diagnostics. Funded by ERC, Prof. Brunsveld and colleagues have developed modular nanoparticles that exactly address the needs of the molecular imaging field. These nanoparticles of organic nature can be produced in a reproducible one-step method by self-assembly in water. The result is a highly-robust and biocompatible nanoparticle that can be modulated to emit any desirable colour frequency with long-term emission and high photostability. Moreover, they can be

functionalised with multiple ligands thanks to great control over surface functionality and can be prepared not only for fluorescent studies, but also for other imaging technologies. In practise this implies that the technology platform can be used to advance a wide range of in-vitro and in-vivo assays and to visualise yet-uncovered processes. It is the objective of BioNLight to select the most interesting applications for commercialisation and to build up a prospectus that can be used to convince future customers of the practicability and the imaging power of our technology platform. Besides, we aim to construct a sound business model and strategy for commercialisation. This will be done by external validation of the nanoparticles by industry followed by final optimisation, by means of an extensive market study, by building a strong IP position and by setting up a business plan with detailed financial feasibility projections. The ERC Proof of Concept Grant will enable us to take the ERC Starting Grant results to a sound business proposition.

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**NBR: 310312** **ACRONYM: RECYVAL-NANO** **EC FUND: 3200097**

**DG:** RTD **Call: FP7-NMP-2012-SME-6** **Thema:** NMP.2012.4.1-2

**Title:** Development of recovery processes for recycling of valuable components from FPDs (In, Y, Nd) for the production of high added value NPs

**Abstract:** Waste Electrical and Electronic Equipment is considered to increase drastically in the coming decades. WEEE contains considerable quantities of valuable components used in high-tech applications that currently are not recycled. Europe needs to improve and develop Recovery, Recycling and Reuse of critical materials in order to avoid the dependency on imports, high prices and risk of supply imposed by countries owning mineral reserves. RECYVAL-NANO project will develop an innovative recycling process for recovery and reuse of indium, yttrium and neodymium metals from Flat Panels Displays (FPD), one of the most growing waste sources. The project will be addressed not only to the recovery of these critical elements, but also the recycling process developed will result in the direct extraction of metallorganic precursors for direct reuse in the production of high added value nanoparticles that is ITO, Y2O3:Eu3+ and Nd-Fe-B. The project will develop an integral study of the recycling process, starting with logistic issues of the waste collection, optimising mechanical sorting technologies and developing innovative ones for the recovery and concentration of smaller fractions containing indium, yttrium and neodymium, developing simplified solvent extraction routes based on tailored chemical extraction agents able to extract a 95 % of the key metal in a metallorganic extracted solutions, and using these extracted solutions as precursors in the direct production of advanced nanoparticles. RECYVAL-NANO will validate the recycling process developed through the construction, optimisation and demonstration of full pilot lines for mechanical recycling of FPDs (500 kg/h) and hydrometallurgical metal recovery processes (500 g/h). Finally, the demonstration of the superior performance application of ITO, Y2O3:Eu3+ and Nd-Fe-B nanoparticles in

electronic applications of transparent conductors, LEDs and permanent magnets respectively will complete the entire cycle of the project.

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**NBR: 310333** **ACRONYM: SOLAROGENIX** **EC FUND: 2755708**

**DG:** RTD **Call: FP7-NMP-2012-SMALL-6** **Thema:** NMP.2012.1.1-1

**Title:** Visible-Light Active Metal Oxide Nano-catalysts for Sustainable Solar Hydrogen Production

**Abstract:** The rising global interest in hydrogen as the fuel of future has prompted tremendous interest in the development of efficient hydrogen production technologies that may serve as economically viable solutions towards solar fuels. The project SOLARGENIX will investigate novel nanostructured photocatalysts starting from comprehensive theoretical and experimental investigations on visible-light active meta-oxides for photoelectrochemical splitting of water to target the environmental hydrogen production from saline water by sun illumination. For this purpose, efficient multi-functional photoactive nano-catalysts will be developed whereby underlying atomic understanding of elementary chemical reactions and electrochemical processes will guard the scope of the project. The development of efficient nano-catalysts will be mastered by novel material combinations and interfacial engineering in nano-hetrostructures. Furthermore the project will demonstrate the feasibility of this technology together with industrial partners to develop first module-sized demonstrators for testing under real operating conditions.

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**NBR: 310337** **ACRONYM: COSMOPHOS-NANO** **EC FUND: 8503352**

**DG:** RTD **Call: FP7-NMP-2012-LARGE-6** **Thema:** NMP.2012.1.2-2

**Title:** Novel nanotechnology-enabled system for endovascular in vivo near-infrared fluorescence molecular imaging and endovascular near-infrared targeted photodynamic therapy of atherosclerotic heart disease

**Abstract:** CosmoPHOS-nano is a multidisciplinary, translational and business-oriented project, aiming to accomplish the following objectives: 1) develop the CosmoPHOS system, which is a novel theranostic (diagnostic & therapeutic) nanotechnology-enabled portable combination system enabling endovascular in vivo near-infrared fluorescence molecular imaging, endovascular near-infrared targeted photodynamic therapy, real-time & follow-up therapy monitoring of atherosclerotic coronary artery disease (CAD), 2) nonclinically evaluate this system, 3) clinically validate the system after regulatory approval, & 4) reduce in the long-term CAD deaths and morbidity by up to 40%, resulting

in a significant decrease of the European and global healthcare costs for CAD, increasing the income of the European healthcare industry from CAD market which is the global largest. The CosmoPHOS-nano consortium has a five year history of successful collaboration between the industrial and academic partners, and its funding would underpin a team devoted to delivering a novel powerful & affordable healthcare solution against the leading cause of death, without the need for heavy and expensive medical equipment. The CosmoPHOS system consists of two interacting components: a) targeted theranostic near-infrared photoactivatable biocompatible nanomedicines, and b) medical devices. After systemic administration, the nanomedicines targeted accumulate in coronary atherosclerotic plaques, followed by endocoronary photoactivation and detection by the medical devices, enabling molecular imaging, targeted therapy, real-time & follow-up therapy monitoring of CAD. Preliminary in vitro & in vivo successful experimental results, as well as parts of the CosmoPHOS system are already available from the prior five year collaboration. The project plan includes: A) nonclinical R&D (30 months); B) nonclinical validation & regulatory approval (18 months); C) first-in-man phase-I clinical trial in 20 CAD patients (12 months).

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**NBR: 310339** **ACRONYM: SYNAPSE** **EC FUND: 2206640**

**DG:** RTD **Call: FP7-NMP-2012-SMALL-6** **Thema:** NMP.2012.2.2-2

**Title:** SYnthesis and functionality of chalcogenide NAnostructures for PhaSE change memories"

**Abstract:** The SYNAPSE project aims at the metalorganic chemical vapor phase deposition (MOCVD) and study of chalcogenide single material, (core) and double material (core-shell) nanowires (NWs), for innovative multi-level phase change memories (PCM). If Ge-Sb-Te is the most studied material for PCM applications, In-based materials, like In-Sb-Te or In-Ge-Te alloys, are also promising, since they are featured by low reset current and high crystallization temperature, paving the way for performing data storage devices even in the automotive field. At the same time, a great attention is currently devoted to the chance to downscale PCM cells by employing chalcogenide NWs. In SYNAPSE, Ge-based and In-based NWs will be first deposited by MOCVD on different substrates and using different bottom-up approaches, the vapor-liquid-solid (VLS) and the selective area growth (SAG). Single material nanowire (SM-NWs) will be in-situ MOCVD-coated by other phase change chalcogenides, to obtain core-shell nanowires (CS-NWs), both free-standing and buried in template matrix. Different material combinations (Ge-Sb-Te/In-Sb-Te/In-GeTe) will be explored in the realization of the CS-NWs, in order to expand the memory level operational features of the obtainable PCM devices. The NW synthesis will be supported by the development and test of precursors for MOCVD. A detailed study of the NW phase switching behavior (reversible amorphous-crystalline transitions) will be carried out and correlated. Special attention will be devoted to the investigation of electrical and thermal properties of the NWs, their phase formation/crystallization

dynamics, size-dependent effects and structural/chemical composition. Experimental work will be supported by theoretical modeling and simulation of both crystallization dynamics and electro-thermal behavior. The SYNAPSE consortium is formed by 7 participants (5 academic/research centers and 2 industries) from Italy (3), France (2), Germany (1) and Ireland (1).

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**NBR: 310344** **ACRONYM: NECSO** **EC FUND: 1968559**

**DG:** RTD **Call: FP7-NMP-2012-SME-6** **Thema:** NMP.2012.1.4-3

**Title:** Nanoscale Enhanced Characterisation of SOlar selective coatings

**Abstract:** Optical coatings are commonly deposited over large areas on different substrates: glass, metals (steel, aluminium...) or polymeric foils (PET...). Production processes involve normally large machinery including many times roll-to-roll processes to deposit multilayers over several square meters of substrates. However, properties of these coatings depend strongly on nanometric properties: composition, crystallography, nanostructure, roughness, homogeneity... Solar selective coatings are considered a special case of optical coatings combining several layers with different properties, mainly: antireflection, solar absorbance and infrared mirror. Nowadays the most demanding solar selective coatings are those used in tubes of high temperature parabolic trough solar collectors. Coatings have to operate in an aggressive environment (temperatures above 400ºC, thermal cycling) during 20-25 years. Besides, further developments require higher temperatures, improved scratch resistance and working under oxidant atmospheres (small quantities of water vapour and oxygen). In order to get significant advances in this field it is essential to have: 1. Nanoscale structure related requirements (nanoroughness, nanohardness, crystallography, composition, vibrational modes) and the correlation with performance requirements: optical and, more important, life expectancy. 2. Standard characterisation and degradation protocols to serve as a powerful tool to coating developers, producers and end users for life prediction and to push the collector parameters (temperatures and environment) to higher efficiency parameters. The main idea behind this NECSO project is to provide tools to the end users namely solar plants builders, to guarantee that the selective coating will work properly during 20 to 25 years. Novel experimental methods for testing materials under extreme conditions (temperature and radiation) are needed providing a deeper understanding of the interaction of electromagnetic radiation with nanomaterials, as basis for design of new spectrally selective absorber coatings. Nanoscale characterisation (roughness, AFM, nanoindentation, scratch-adhesion, crystallography by FESEM-EBSD, Raman, RX, XPS, etc) will correlate the nanostructure parameters with coating performance. The resulting outcomes are expected to contribute significantly to the infrastructure of the solar energy research, development and industrial activities worldwide. Additionally, the designed testing protocols should help coating developers to compare available layers and newly designed ones, with

standard procedures. Finally, testing procedures will also be of utter importance to have a fast quality control on the coatings, typically in 4 meter tubes, over some tens of kilometres in a common cylinder parabolic solar plant.

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**NBR: 310397** **ACRONYM: NATURAL** **EC FUND: 2333750**

**DG:** RTD **Call: FP7-NMP-2012-SME-6** **Thema:** NMP.2012.1.4-3

**Title:** Standardised metrology of Nano-sTrUctuRed CoAtings with Low surface energy

**Abstract:** There is a growing range of applications that would benefit from the use of nanostructured coatings. The functional performance of a surface is intimately linked with its structure. The ability to characterise nanostructured coatings is therefore an essential part of their future uptake. However, the ability to examine and characterise at the nano-scale is currently limited to sophisticated, time-consuming laboratory based equipment. The standards body (ISO TC229) recognises that there are no current procedures that relate the functional performance of a surface or coating to its nanostructure, however, it is recognised that loss of the nanostructure frequently leads to a loss of performance. The NATURAL project will develop methods that allow rapid evaluation of surfaces at the nanoscale and correlate the measured surface structure with functional performance. This step change in measurement methodology will enable new lifetime determination methods and enhance the knowledge base for providers of nanostructured coatings and surfaces to tailor their products and technologies towards the end-user needs. This will facilitate the entrance into the market place of novel nanostructured coatings with proven capability to improve properties such as fouling resistance. In order to achieve this, NATURAL will focus on the development of surface profilometry methods to allow the rapid resolution of surfaces at the nanoscale. These methods will be correlated with the physical and physico-chemical characteristics of surfaces to allow their rapid, reliable and accurate assessment. The change of the surface nano-morphology and the functional performance will be related to allow the estimation of durability and to enable the development of new methods for lifetime determination and, ultimately, prediction of in-service performance throughout the lifetime of the surface structure.

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**NBR: 310420** **ACRONYM: HYPERCONNECT** **EC FUND: 3166808**

**DG:** RTD **Call: FP7-NMP-2012-SMALL-6** **Thema:** NMP.2012.2.1-1

**Title:** Functional joining of dissimilar materials using directed self-assembly of nanoparticles by capillary-bridging

**Abstract:** Tomorrows micro-electronic devices will have to show more functionality and performance at smaller form factor, lower cost and lower energy consumption in order to be competitive on this multi-billion dollar market. Advanced system integration is thus inevitable, a trend bound to joining dissimilar materials with new packaging technologies. These processes must enable lower thermal resistances and higher interconnect density and device reliability under thermomechanical loading. Hyperconnect addresses these challenges by a radically new material joining process. The objective is to demonstrate superior electrical, thermal and thermomechanical performance and to combine design and technology with the support of simulation and testing. The central new idea comprises a sequential joint forming process, using self-assembly of nanoparticles, polymers and filler composite materials exploiting capillary action and chemical surface functionalisation: In other words, the formed joint reaches its outstanding properties by the very processing of the materials. This contrast to existing technology demands own understanding of the joint formation, joint property creation and the joint reliability. Therefore advanced experimental characterization and simulation techniques will accompany the material and technology development, in particular involving physics-of-failure-based lifetime modelling. Finally, the joint performance will be validated on four different demonstrators of industrial significance. To tackle these challenging issues the consortium pools the required interdisciplinary excellence, by uniting nine partners from industry, SMEs and academia of five European countries. Its members are convinced that these new developments will outperform commercially available solutions by one order of magnitude and will radiate out also to other fields in electronic packaging.

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**NBR: 310445** **ACRONYM: SAVVY** **EC FUND: 3782729**

**DG:** RTD **Call: FP7-NMP-2012-SMALL-6** **Thema:** NMP.2012.1.4-2

**Title:** Self-assembled virus-like vectors for stem cell phenotyping

**Abstract:** The Self-Assembled Virus-like Vectors for Stem Cell Phenotyping (SAVVY) project relies on hierarchical, multi-scale assembly of intrinsically dissimilar nanoparticles to develop novel types of multifunctional Raman probes for analysis and phenotyping of heterogeneous stem cell populations. Our project will address a large unmet need, as stem cells have great potential for a broad range of therapeutic and biotechnological applications. Characterization and sorting of heterogeneous stem cell populations has been intrinsically hampered by (1) lack of specific antibodies, (2) need for fluorescence markers, (3) low concentration of stem cells, (4) low efficiencies/high costs. Our technology will use a fundamentally different approach that (1) does not require antibodies, aptamers, or biomarkers, (2) is fluorescence-label free, and (3) is scalable at acceptable cost. The approach uses intrinsic differences in the composition of membranes of cells to distinguish cell populations. These differences will be detect by SERS and analysed through multicomponent analysis. We have combined the necessary

expertise to tackle this challenge: Stellacci has developed rippled nanoparticles that specifically interact with and adhere to cell membranes (analogues to cell penetrating peptides). Lahann has developed bicompartmental Janus polymer particles that have already been surface-modified with rippled particles and integrate specifically in the cell membrane (analogues to viruses). Liz-Marzan has developed highly Raman-active nanoparticles and has demonstrated their selectivity and specificity in SERS experiments. These Raman probes will be loaded into the synthetic viruses to enable membrane fingerprinting. Stevens has developed a Bioinformatics platform for fingerprinting of stem cell populations using cluster analysis algorithms. The effort will be joined by two SMEs, ChipShop and OMT, that will be able to develop the necessary microfluidic and Raman detection hardware.

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**NBR: 310451** **ACRONYM: NANOMILE** **EC FUND: 9624979**

**DG:** RTD **Call: FP7-NMP-2012-LARGE-6** **Thema:** NMP.2012.1.3-1

**Title:** Engineered nanomaterial mechanisms of interactions with living systems and the environment: a universal framework for safe nanotechnology

**Abstract:** The NanoMILE project is conceived and led by an international elite of scientists from the EU and US with the aim to establish a fundamental understanding of the mechanisms of nanomaterial interactions with living systems and the environment, and uniquely to do so across the entire life cycle of nanomaterials and in a wide range of target species. Identification of critical properties (physico-chemical descriptors) that confer the ability to induce harm in biological systems is key to allowing these features to be avoided in nanomaterial production ("safety by design"). Major shortfalls in the risk analysis process for nanomaterials are the fundamental lack of data on exposure levels and the environmental fate and transformation of nanomaterials, key issues that this proposal will address, including through the development of novel modelling approaches. A major deliverable of the project will be a framework for classification of nanomaterials according to their impacts, whether biological or environmental, by linking nanomaterial-biomolecule interactions across scales (sub-cellular to ecosystem) and establishing the specific biochemical mechanisms of interference (toxicity pathway).

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**NBR: 310465** **ACRONYM: MEMBRANENANOPART** **EC FUND: 999810**

**DG:** RTD **Call: FP7-NMP-2012-SMALL-6** **Thema:** NMP.2012.1.3-2

**Title:** Modelling the mechanisms of nanoparticle-lipid interactions and nanoparticle effects on cell membrane structure and function

**Abstract:** The central goal of our proposal is to develop physically justified models and computational tools to quantitatively describe and understand the molecular mechanisms of nanoparticle-cell membrane interactions, which we consider to be a crucial point in any predictive model of nanoparticle toxicity. We consider mechanisms of nanoparticle protein corona formation, the protective function of the membrane, nanoparticle uptake into the cell, and the effect of nanoparticles on the cell membrane. We plan to develop a consistent multiscale simulation scheme starting from nanoparticle-biomolecule interaction at the atomistic scale using molecular dynamics simulation, and then systematically constructing coarse-grained mesoscale models for simulating the structure and dynamics of the cell membrane perturbed by nanoparticles at the physiologically relevant time and length scales. We will develop and test a universal method for evaluating the rates of nanoparticle translocation through membranes and evaluate associated specific toxicity effects. Based on the information acquired from the simulations and analyzed together with available experimental data, the toxicological impact will be deduced. We will apply our approach to a range of common engineered nanoparticles, relating their physicochemical properties such as size and shape, surface charge, hydrophobicity (logP), and plasma protein binding affinity to the toxicological effects and develop a test suite allowing to make toxicity prediction on the basis of purely computational or limited in vitro screening tests.

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**NBR: 310483** **ACRONYM: SKYCOAT** **EC FUND: 3224161**

**DG:** RTD **Call: FP7-NMP-2012-SME-6** **Thema:** NMP.2012.4.0-1

**Title:** Sky Like Coating Materials for Hypogeal and SkyScrapers Architectures

**Abstract:** Building skyscrapers, Real Estate has to constantly deal with social, economical and political issues. Nowadays market calls for a less conflictual and more profitable development niche, until now especially limited by livability and psychological constrains coming from the absence of natural light: underground architecture, including earth-sheltered and earth-covered buildings. Hypogeal spaces can tackle congestion, lack of open public space and aging infrastructures, exponentially increasing urban design opportunities to populate the “volume” contained by an over exploited earth surface. Underground can limit visual impact (zeroing main concerns about skyscrapers)and promote efficient land use in a noise and vibration-free environment, reducing energy costs by heat loss and daily temperature fluctuations control. Until now the discomfort caused by sky and sun deprivation consents hypogeal architecture only where protection from harsh climate conditions and natural disasters count more than above mentioned discomfort. SkyCoat, with a great leap underground, recreates the experience of natural light, obtained by complementary presence of both direct sun and diffused sky lights. Disadvantages of hypogeal architecture, like limited or no natural light and negative psychological reactions, are blown away by the possibility of reproducing the sun and the sky many meters under the earth surface, therefore

opening a new and unexplored territory for real estate investors, architecture designers and buildings end-users. SkyCoat technology will also be verified in light design, testing how housing, offices, retail, industry and transport, can benefit from indoor natural light reproduction. At the same time, SkyCoat will be tested as coating material for skyscrapers: a thin layer of a nano-structured dichroic material will reflect warm sun light and scatter complementary cold sky component, allowing a tailor-made silhouette not necessarily corresponding to the building volume

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**NBR: 310516** **ACRONYM: NANOPYME** **EC FUND: 3479493**

**DG:** RTD **Call: FP7-NMP-2012-SMALL-6** **Thema:** NMP.2012.4.1-3

**Title:** Nanocrystalline Permanent Magnets Based on Hybrid Metal-Ferrites

**Abstract:** This project addresses the design and development of permanent magnets without rare earths but consisting on hybrid nanostructures based on metals and metal ferrite oxides. The metallic nanostructures offers high magnetization values while the ferrite oxide one provides high anisotropy. We intend to design and process novel permanent magnets based on traditional hard ferrites and additional new magnetic phases combined with a soft magnetic phase to achieve high magnetic performance through effective exchange-coupling of both magnetic phases. This phenomenon has been extensively studied in metallic systems but not in oxide nanocomposite permanent magnets, where the studies are very scarce mainly due to the difficulty in optimizing the magnetic properties because of microstructural complexities. In view of practical applications this will guarantee their use in some nowadays applications which are currently covered by more expensive rare-earth permanent magnets, simply because typical ferrites do not fulfill the required magnetic energy product. This “no-man's-land” applications area - characterized by required energy products between 35 to 100 kJ/m3 - includes fundamental fields such as diverse components for transport and energy applications. As an important consequence, the use of rare-earth based permanent magnets will be reduced to its maximum possible extent by fulfilling the needs for a broad applications range by these newly designed rare-earth free permanent magnets. This project is therefore important from a fundamental as well as from a practical point of view where the complementary expertise areas of the different groups will combine to achieve the proposed objectives.

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**NBR: 310531** **ACRONYM: HYDROBOND** **EC FUND: 2929476**

**DG:** RTD **Call: FP7-NMP-2012-SMALL-6** **Thema:** NMP.2012.2.2-4

**Title:** New cost/effective superHYDROphobic coatings with enhanced BOND strengh and wear resistance for application in large wind turbine blades.

**Abstract:** The main objective of HYDROBOND is the development of a highly innovative process for application of superhydrophobic coatings onto large off-shore turbine blades, that will contribute to minimize the power losses and mechanical failures. Novel thermal spray technologies will be the way to achieve the nanostructured coatings with tailored anti-icing properties and enhanced bond strengh, in a cost effective manner for very large, composite material surface. The pursued scientific-technological objectives and impacts derived from HYDROBOND project are - Based on the properties of the new coatings, that will act as a passive anti-icing method, allow the design and construction of lighter larger wind turbines, avoiding the needs of heavier active anti-icing methods. - Due to the anti-icing properties, new coatings will allow the minimization of the ice accretion and will increase the reliability and operational life of components by reducing the mechanical failures. As already stated in this proposal, ice accretion will increase the load on the blades and on the tower structure, causing high amplitude vibrations and/or resonance as well as mass imbalance between blades, affecting specially the gearboxes whose lifetime is considerably reduced. - New anti-icing coatings will improve the cost/efficiency ratio of the blades, because ice accretion changes the shape and roughness of the blade airfoil significantly reducing aerodynamic properties of the blade resulting in power losses. - Due to the enhanced bond strengh and the ability to keep the anti-icing properties even when wear phenomena happens, will contribute on reducing the maintenance needs. The new developed process, being a portable one, will also contribute to reduce the maintenance cost of off-shore wind turbines allowing in situ repair.

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**NBR: 310584** **ACRONYM: NANOREG** **EC FUND: 10000000**

**DG:** RTD **Call: FP7-NMP-2012-LARGE-6** **Thema:** NMP.2012.1.3-3

**Title:** A common European approach to the regulatory testing of nanomaterials

**Abstract:** The innovative and economic potential of Manufactured Nano Materials (MNMs) is threatened by a limited understanding of the related EHS issues. While toxicity data is continuously becoming available, the relevance to regulators is often unclear or unproven. The shrinking time to market of new MNM drives the need for urgent action by regulators. NANoREG is the first FP7 project to deliver the answers needed by regulators and legislators on EHS by linking them to a scientific evaluation of data and test methods. Based on questions and requirements supplied by regulators and legislators, NANoREG will: (i) provide answers and solutions from existing data, complemented with new knowledge, (ii) Provide a tool box of relevant instruments for risk assessment, characterisation, toxicity testing and exposure measurements of MNMs, (iii) develop, for the long term, new testing strategies adapted to innovation

requirements, (iv) Establish a close collaboration among authorities, industry and science leading to efficient and practically applicable risk management approaches for MNMs and products containing MNMs. The interdisciplinary approach involving the three main stakeholders (Regulation, Industry and Science) will significantly contribute to reducing the risks from MNMs in industrial and consumer products. NANoREG starts by analysing existing knowledge (from WPMN-, FP- and other projects). This is combined with a synthesis of the needs of the authorities and new knowledge covering the indentified gaps, used to fill the validated NANoREG tool box and data base, conform with ECHA's IUCLID DB structure. To answer regulatory questions and needs NANoREG will sett up the liaisons with the regulation and legislation authorities in the NANoREG partner countries, establish and intensify the liaisons with selected industries and new enterprises, and develop liaisons to global standardisation and regulation institutions in countries like USA, Canada, Australia, Japan, and Russia.

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**NBR: 310637** **ACRONYM: SMILEY** **EC FUND: 3996103**

**DG:** RTD **Call: FP7-NMP-2012-SMALL-6** **Thema:** NMP.2012.1.4-2

**Title:** Smart nano-structured devices hierarchically assembled by bio-mineralization processes

**Abstract:** SMILEY aims to develop and apply a "bottom-up" approach to build nano-structured devices with smart multi-functional properties: bio-mineralization, self-assembly, self-organization are an ensemble of concomitant phenomena, inspired by nature, that will be properly directed to generate elementary nano-sized building blocks organized in macroscopic devices for application in EHS (Environment, Health, Safety) Biomedical and Energy fields. SMILEY will exploit the ability of such a cascade of biologically-inspired processes to form complex hybrid nano-composites, starting from abundant and environmentally safe raw materials such as natural polymers and fibres, whose characteristics and organization are mediated by the activation of control mechanisms and structural confinement conferring defined functionalities to the final devices. The processes of self-assembling and mineralization, scaled at pilot plant, will be directed and adjusted to obtain 3-D porous hybrid nano-composites to be used as: i) filters for air purification from nano-particles; ii) biomedical devices exhibiting high mimesis with human hard tissues, addressed to dental regeneration; iii) fibrous integrated photovoltaic devices. The control mechanisms inherent in the whole process will allow to establish a technological platform based on highly repeatable, scalable and cost-effective technology for the manufacturing of multi-functional devices with huge economic, environmental and social impact. This will also represent a proof of concept for further development of smart devices obtained by biologically-inspired self-assembling processes; in this respect, roadmaps addressing wider industrial exploitation will be prepared, basing on the knowledge gained in the development of SMILEY.

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**NBR: 310892** **ACRONYM: POROUS SILICON NANOV** **EC FUND: 1499603**

**DG:** ERCEA **Call: ERC-2012-StG_20111109** **Thema:** ERC-SG-LS7

**Title:** Multistage-Multifunctional Porous Silicon Nanovectors for Directed Theranostics

**Abstract:** The progress of nanotechnology during the last decades has had a strong impact to the current research of biomedical applications, in particular against dreadful diseases such as cancer. It is estimated that more than 12 million cases of cancer are diagnosed every year worldwide. Multidrug resistance, rapid elimination by the immune system, enzymatic degradation, and poor targeting efficiency are still the major obstacles of the nanomedicines used in cancer therapy. The integration of imaging and therapeutic agents into a single carrier (theranostics) allows simultaneously detection, diagnostics, and treatment of the diseases, which may enhance both expectancy and quality of life of the patients. In the proposed project a systematic approach is taken towards developing and testing of novel multistage–multifunctional nanovectors based on the fusion between stage-2 nanoporous silicon nanoparticles and stage-1 polymersomes (fused materials = protocells, cell-like particles) for directed (targeted/personalized) therapy and multimodal imaging. With this approach it is aimed to decouple the quadruple functions of the protocell nanovectors in order to generate relevant preclinical information for rapid translation into the clinic: sufficient multifunctionality to avoid biological barriers, recognition of their targets, accounting for non-invasive in vivo imaging and delivery of therapeutics. The overall distinct and final milestones are: to ligand-anchored, co-loading of drug(s)-dye(s), and dual radiolabelling of the precisely tailored protocell nanovectors for simultaneously targeting the tumour vasculature cells, stimulating the immune system response and multimodal imaging in vivo. It is also aimed to evaluate the suitability and effectiveness of the designed nanodevices by employing in vitro models and in vivo imaging techniques and to achieve a comprehensive and deeper understanding on the cellular interactions between the protocell nanovectors and the cancer cells.

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**NBR: 310985** **ACRONYM: NASTAR** **EC FUND: 1498731**

**DG:** ERCEA **Call: ERC-2012-StG_20111109** **Thema:** ERC-SG-LS7

**Title:** Nano-Sensitizer Cancer Cell Targeted Radiotherapy

**Abstract:** Targeted chemotherapy in combination with external beam radiation therapy (radiotherapy) is a promising approach to significantly improve the therapeutic outcome for cancer patients. To achieve this, it is essential to develop drug delivery technology that specifically delivers the chemotherapeutic drugs to cancerous tissue. Radiotherapy is an indispensable part of modern cancer treatment; however, despite efforts in

improving planning and execution of treatment, the unbalance between therapeutic benefit and side effects limits cure rates, and new approaches are needed to bring to fruition the full potential of radiotherapy. Today, there is considerable focus on systemically administered radiosensitizers for enhancing the effect of radiotherapy and clinical investigations have shown promising results; however, radiosensitizer use is hampered by considerable side effects due to lack of drug targeting to the cancerous tissue. In the first phase of this project, the aim is to develop tumor targeted nanocarrier delivery systems of radiosensitizers to enhance their therapeutic potential and provide a more efficient and site-directed effect of radiotherapy. In the second phase of the project, nanocarriers for tumor specific delivery of checkpoint inhibitors of cancer cell repair mechanisms will be investigated as an additional targeting strategy for sensitizing cancer cells to radiotherapy. The idea is to circumvent cell cycle checkpoints of DNA damage induced by tumor radiation and thereby enhance mitotic catastrophe. This approach will in combination with the delivery of conventional radiosensitizer drugs, further lower the radiation dose needed to induce irreversible damage to cancer cells. Thus, the project aims to develop targeted nanocarriers for high precision delivery of radiosensitizing drugs to cancerous tissue for enhancing the effect of radiotherapy. We aim to demonstrate the applicability and clinical potential of this new approach within the project period

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**NBR: 311086** **ACRONYM: 3PS** **EC FUND: 998584**

**DG:** ERCEA **Call: ERC-2012-StG_20111109** **Thema:** ERC-SG-LS7

**Title:** 3Ps Plastic-Antibodies Plasmonics and Photovoltaic-Cells: on-site screening of cancer biomarkers made possible"

**Abstract:** This project presents a new concept for the detection, diagnosis and monitoring of cancer biomarker patterns in point-of-care. The device under development will make use of the selectivity of the plastic antibodies as sensing materials and the interference they will play on the normal operation of a photovoltaic cell. Plastic antibodies will be designed by surface imprinting procedures. Self-assembled monolayer and molecular imprinting techniques will be merged in this process because they allow the self-assembly of nanostructured materials on a “bottom-up” nanofabrication approach. A dye-sensitized solar cell will be used as photovoltaic cell. It includes a liquid interface in the cell circuit, which allows the introduction of the sample (also in liquid phase) without disturbing the normal cell operation. Furthermore, it works well with rather low cost materials and requires mild and easy processing conditions. The cell will be equipped with plasmonic structures to enhance light absorption and cell efficiency. The device under development will be easily operated by any clinician or patient. It will require ambient light and a regular multimeter. Eye detection will be also tried out.

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**NBR: 311122** **ACRONYM: BIOPROBE** **EC FUND: 1488600**

**DG:** ERCEA **Call: ERC-2012-StG_20111109** **Thema:** ERC-SG-LS7

**Title:** VERTICAL MICROFLUIDIC PROBE: A nanoliter "Swiss army knife" for chemistry and physics at biological interfaces

**Abstract:** Life is fundamentally characterised by order, compartmentalisation and biochemical reactions, which occurs at the right place right time – within, on the surface and between cells. Only a proportion of life processes can be addressed with contemporary approaches like liquid encapsulations (e.g. droplets) or engineering compartments (e.g. scaffolds). I believe these approaches are severely limited. I am convinced that a technique to study, work and locally probe adherent cells & tissues at micrometer distances from cell surfaces in “open space” would represent a major advance for the biology of biointerfaces. I therefore propose a non-contact, scanning technology, which spatially confines nanoliter volumes of chemicals for interacting with cells at the µm-length scale. This technology called the vertical microfluidic probe (vMFP) – that I developed at IBM-Zurich – shapes liquid on surfaces hydrodynamically and is compatible with samples on Petri dishes & microtiter plates. The project is organized in 4 themes: (1) Advancing the vMFP by understanding the interaction of liquid flows with biointerfaces, integrating functional elements (e.g. heaters/electrodes, cell traps) & precision control. (2) Developing a higher resolution method to stain tissue sections for multiple markers & better quality information. (3) Retrieving rare elements such as circulating tumor cells from biologically diverse libraries. (4) Patterning cells for applications in regenerative medicine. Since cells & tissues will no longer be limited by closed systems, the vMFP will enable a completely new range of experiments to be performed in a highly interactive, versatile & precise manner – this approach departs from classical “closed” microfluidics. It is very likely that such a tool by providing multifunctional capabilities akin to the proverbial ‘Swiss army knife’ will be a unique facilitator for investigations of previously unapproachable problems in cell biology & the life science.

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**NBR: 311529** **ACRONYM: LT-NRBS** **EC FUND: 1499880**

**DG:** ERCEA **Call: ERC-2012-StG_20111109** **Thema:** ERC-SG-LS9

**Title:** Lab-in-a-tube and Nanorobotic biosensors

**Abstract:** The goal of this project is to develop new types of biosensors based on two different approaches: (i) a new bioanalytic microsystem platform for cell growth, manipulation and analysis using on-chip integrated microtubes and (ii) the use of synthetic self-propelled nanomotors for bioanalytical and biosensing applications. Based on the novel

“Lab-in-a-tube” concept, we will design a multifunctional device for the capturing, growth and sensing of single cell behaviours inside “glass” microtubes to be employed for diverse biological applications. We will decorate the walls of the microtubes with proteins from the extracellular matrix enabling the long-term study of cellular changes such as mitosis time, spindle reorientation, DNA damage and cellular differentiation. These microtubes are fabricated by the well-established rolled-up nanotechnology developed in the host institution. Moreover, the multifunctionality of the “Lab-in-a-tube” platform will be extended by integrating different modules into a single microtubular unit, bringing up several applications such as optofluidics(bio)sensors, electrodes for electrochemical control and sensing, and magnetic biodetection. At the IIN institute in IFW Dresden, we are pioneers on the fabrication of catalytic microjet engines (microbots) and their use for transporting different kinds of objects in vitro into a fluid. The remote controlled motion of these autonomous microbots and the transport of microobjects and cells to specific targets within lab-on-a-chip systems is possible. Their walls can be biofunctionalized with enzymes, antibodies or DNA, the catalytic microbots representing a novel and unique tool for biosensing, environmental and biomedical applications. Our next step is to use biocompatible fuels to propel these microbots with the final aim of transporting and delivering drugs in vivo.The separation of cancer cells, bacteria and other biomaterials to build up new tissues or to replace disease cells are also aimed.

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**NBR: 311532** **ACRONYM: ELENA** **EC FUND: 1155970**

**DG:** ERCEA **Call: ERC-2012-StG_20111109** **Thema:** ERC-SG-LS9

**Title:** Electrochemical LEctin and glycan biochips integrated with NAnostructures

**Abstract:** Glycomics is currently one of the most progressively evolving scientific fields due to ever growing evidence glycans (sugars) are involved in many aspects of cell physiology and pathology. Glycans are information-rich molecules responsible for sophisticated storage and coding “commands” the cell has to perform to stay “fit” and to deal with uninvited pathogens. Thus, it is very important the “glycocode” is correctly deciphered by the cell to stay healthy, but pathogens developed nasty tricks how to crack the “glycocode“ to their benefit by stealing glycan identity of the host to stay unrecognised until it is too late. A better understanding of these processes can help to develop new, potent and nature-based vaccines and drugs. Glycomics stayed behind advances in genomics and proteomics, but due to advent of high-throughput biochips glycomics is catching up very quickly. Two biochip formats available to study challenging and complex field of glycomics are either based on immobilised glycans (glycan biochips) or glycan recognising molecules – lectins (lectin biochips). Both technologies proved to be a success story to reveal amazing, precisely tuned “glycocode” reading, but so far biochips do not work under conditions resembling natural process of glycan deciphering. The aim of the project is to develop biochips for fundamental study of the effect of precisely

tuned ligand (glycan and lectin) density, presence of mixed glycans and the length of glycans on the glycan biorecognition. This task will be executed with the aid of nanotechnology to control these aspects at the nanoscale. Moreover, novel label-free electrochemical detection strategies will be used to mimic natural glycan recognition performing without any label. Finally, advanced patterning protocols and novel detection platforms will be integrated to develop fully robust biochips for functional assay of samples from people having some disease with a search for a particular biomarker of the disease.

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**NBR: 311536** **ACRONYM: MEMFIS** **EC FUND: 1374882**

**DG:** ERCEA **Call: ERC-2012-StG_20111109** **Thema:** ERC-SG-LS3

**Title:** Mechanical Understanding of Membrane Fission in Endocytosis and Cytokinesis

**Abstract:** The envelope of living cell is a lipid membrane. It is rather difficult to break, to ensure cell survival when under mechanical stress. However, in many events of cell life, the membrane needs to be broken in a controlled manner. It is the case in Endocytosis, when membrane carriers budding from the plasma membrane need to be separated from the plasma membrane, in order to uptake external components needed for the cell life. This reaction is called fission. It is also the case at the final step of cell division, cytokinesis, when the connecting membrane bridge between the two daughter cells is broken in a process called abscission. Even if fission and abscission machineries have been identified and are different, the reaction by which they break membranes should be the same, but is still unknown. By using membrane physics concepts and tools, we will investigate the mechanics of these two fission machineries. As they have different dynamics (tens of seconds for fission, tens of minutes for abscission), different scales (tens of nanometers for fission, microns for abscission) and different topology (fission machinery works from outside the neck, abscission machinery works from inside the neck), we will: 1-explain how each machinery breaks membranes, 2-find essential parameters that control all membrane fission reactions. We will thus draw a mechanical framework to then understand the role of keyfactors in all membrane fission reactions of cells.

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**NBR: 311933** **ACRONYM: WATER4CROPS** **EC FUND: 5973689**

**DG:** RTD **Call: FP7-KBBE-2012-6-singlestage** **Thema:** KBBE.2012.3.5-03

**Title:** Integrating bio-treated wastewater with enhanced water use efficiency to support the Green Economy in EU and India

**Abstract:** Water4Crops provides a combination of technical improvements in the field of bio-treatment and agricultural water use within a transdisciplinary identification of novel agri-business opportunities. Water4Crops aims at: a) developing innovative biotechnological wastewater treatments for improved water recycling, b) initiating the co-creation of alternative combinations of bio-treatment, recycling of high value elements, and combinations for bioproducts leading to a better commercialization of biotechnology and agricultural products in Europe and India, c)improving water use efficiency at field level through agronomics, plant breeding and locally adapted new irrigation technologies and accurate crop water requirement measurements techniques. Water4Crops will boost bio-based economy by applying a double track approach. First a comprehensive set of key Green-Economy technologies for: 1) valorization of volatile fatty acids; 2) obtaining: natural antioxidants (polyphenols), biopolymers (PHAs), energy (biomethane); 3) new substances for selective recovery of valuable products from wastewater; 4) tailoring effluent properties from decentralized innovative bioreactors; 5) low bio-sludge production by SBBG Reactors; 6) removal of organopollutants by nanobiocatalysts; 7) reduced clogging of wetlands; 8) virus monitoring detection assays; 9) suitable precision irrigation systems for reclaimed water; 10) new monitoring for increase crop water productivity; 11) understanding the genetic mechanisms regulating drought-adaptive traits across maize, sorghum, millet and tomato; 12) optimized waste water related combinations of species/genotypes x environment x management. Second, new product market combinations will be identified. The co-creation process will be organized by two Mirror cases (Emilia Romagna area in Italy and Hyderabad region in India) within a specific Science-Practice Interface (INNOVA platforms). Developing the new applications and business opportunities with regional enterprises and stakeholder will move India and Europe towards a Green Economy.

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**NBR: 312004** **ACRONYM: INTENSO** **EC FUND: 5260960**

**DG:** RTD **Call: FP7-KBBE-2012-6-singlestage** **Thema:** KBBE.2012.3.3-03

**Title:** Gaining Productivity, Cost Efficiency and Sustainability in the Downstreaming Processing of Bio Products by novel Integration and Intensification strategies

**Abstract:** The European Life science and chemical industries increasingly depend on effi-cient, sustainable, and cost-effective bioprocessing platforms to remain competi-tive. A critical assessment of current bottlenecks during (bio) manufacturing clearly indicates that the recovery and purification of biologicals in large scale in responsible for many inefficiencies. INTENSO proposes an evaluation of the current situation of the downstream processing scenario with the aim of identifying inefficiencies and concomitantly introduce a debottlenecking overarching strategy. The later will be build up on the basis of a multidisciplinary approach, which considers opportunities to im-prove the process technology and underlying chemistry / biology and materials science at the same time. INTENSO will work alongside 4 technological axes, targeting promising

and up-coming technologies and tailoring such technologies to the manufacturing of various classes of (bio) products. Intensification of individual unit operations and global process integration, as well as, dovetailing with fermentation / cell cultivation will be employed to the mentioned end. INTENSO will target new classes of (bio) products like Monoclonal Antibodies (Mabs), pDNA (e.g. for genetic vaccination), Virus Like Particles (VLP) or nano-plexes. All the mentioned new products are part of most industrial R&D pipelines and offer an excellent opportunity to introduce innovative bioprocessing. The results of the project are expected to contribute to the understanding of current industrial downstream processing practice, to the definition and alleviation of current inefficiencies, to the development and / or implementation of novel technologies, and to more efficient / sustainable and cost effective (bio) manufacturing. Various technologies will be studied utilizing a nano-to-process strategy so as to introduce integration / intensification during bioprocessing.

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**NBR: 312216** **ACRONYM: PEASSS** **EC FUND: 1994537**

**DG:** REA **Call: FP7-SPACE-2012-1** **Thema:** SPA.2012.2.2-01

**Title:** Piezoelectric Assisted Smart Satellite Structure

**Abstract:** The main objective of the PEASSS project is to develop, manufacture, test and qualify "smart structures" which combine composite panels, piezoelectric materials, and next generation sensors, for autonomously improved pointing accuracy and power generation in space. The smart panels will enable fine angle control, and thermal and vibration compensation, improving all types of future Earth observations, such as environmental and planetary mapping, border and regional imaging. This new technology will help keep Europe on the cutting edge of space research, potentially improving the cost and development time for more accurate future sensor platforms including synthetic aperture optics, moving target detection and identification, and compact radars. The system components include new nanosatellite electronics, a piezo power generation system, a piezo actuated smart structure, and a fiber-optic sensor and interrogator system. The designs will be prototyped into breadboard models for functional development and testing. Following completion of operational breadboards, components will evolve to flight-test ready hardware and related software, ready to be integrated into a working satellite. Once the nanosatellite is assembled, on ground tests will be performed. Finally, the satellite will be launched and tested in space. Results of the program will be disseminated to industry through a project website, papers, courses, and presentations. Actuated "smart structure" technology will take the first steps toward space qualification in the PEASSS project, making it a proven viable technology, with a high TRL available to improve future European space missions. PEASSS technologies will give European space, aviation, and other industries a new tool in their design repertoire. The PEASSS consortium aligns established aerospace contributing

organizations with SME's and university researchers, including members from Germany, The Netherlands, Belgium, as well as Israel.

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**NBR: 312483** **ACRONYM: ESTEEM 2** **EC FUND: 7500000**

**DG:** RTD **Call: FP7-INFRASTRUCTURES-2012-1** **Thema:** INFRA-2012-1.1.22.

**Title:** Enabling Science and Technology through European Electron Microscopy

**Abstract:** ESTEEM2 is an integrated infrastructure of electron microscopy facilities providing access for the academic and industrial research community in the physical sciences to some of the most powerful characterization techniques available at the nanoscale. Transnational access to ESTEEM2 centres is obtained through a transparent, simple peer review process based on merit and scientific priorities. Service to users is supported by a networking programme which addresses key issues such as specimen preparation, data interpretation through theory and simulation, and standardization of protocols and methodologies. A series of schools and workshops provide training in innovative methods in electron microscopy and a forum for discussing emerging (cutting-edge) techniques. Directed research programmes focus on the further development of electron diffraction, imaging and spectroscopy and the advancement of 3D methods and time resolved experiments. In all, ESTEEM2 establishes a strategic leadership in electron microscopy to guide future developments and promote electron microscopy to the wider research community at large.

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**NBR: 312993** **ACRONYM: SME-SAT** **EC FUND: 1420867**

**DG:** REA **Call: FP7-SPACE-2012-1** **Thema:** SPA.2012.3.1-01

**Title:** Small and Medium Enterprise Satellite (SME-SAT)

**Abstract:** Fueled by mass market demand, terrestrial consumer electronics continue to drive technology advancement in the field of microelectronics devices. Many of these technologies are spearheaded by the contributions of Small and Medium Enterprise (SME). There is a clear opportunity to revolutionize space technologies by leveraging advancement in the commercial electronics market. However, despite the obvious benefits to the space industry, it remains difficult for SMEs to get involved due to the significant cost, effort, time, and paper work to qualify parts for space applications. A trend toward smaller and cheaper satellites allows for a novel approach to space qualification and testing. Nanosatellites (between 1kg and 10kg) can be launched at a relatively low cost as piggy back payloads for larger satellite missions. Since the cost of failure is an order of magnitude lower than conventional satellites, nanosatellites offer

an ideal platform for high risk demonstration missions. The aim of this project is to flight qualify a wide range of SME payloads in a 3U 3kg nanosatellite platform operating at a 700km orbit. The primary purpose of this spacecraft is as a technology demonstrator. Each SME in the consortium will be responsible for contributing a particular spacecraft subsystem. The University of Surrey will integrate these systems into the nanosatellite platform, and will also be responsible for the ADCS and CMGs of the satellite. ISIS will oversee the launch opportunity and deployment of the satellite. Astrium, as a Large System Integrator (LSI), will help roadmap the technology demonstrated in this mission to future applications within the European space framework.

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**NBR: 313037** **ACRONYM: MERMIG** **EC FUND: 1495364**

**DG:** REA **Call: FP7-SPACE-2012-1** **Thema:** SPA.2012.3.1-01

**Title:** Modular CMOS Photonic Integrated Micro-Gyroscope

**Abstract:** Space system vendors seek for solutions to deliver small size and cost-effective sensor systems to “de-congest” satellite payloads, drastically reduce the equipment cost and open the possibility for new generation of micro-payload systems. MERMIG aims to provide this technology replacing current expensive, bulky, heavy and power-consuming fiber optic gyroscopes (FOGs). To address these key challenges, MERMIG invests in the right mix of silicon photonic CMOS-compatible component fabrication and nano-imprint lithography laser fabrication. Both technologies are being adopted by the terrestrial telecom market and MERMIG will develop them for bringing their unique advantages into space sensor systems. MERMIG will squeeze the bulky FOG into a couple of cm2, integrating a racetrack cavity, pin junctions and a phase decoder into compact sub-micron waveguides. The MERMIG “smart” packaging technique will allow power-efficient optical pumping and hermetic packaging of the gyro-photonic chip. MERMIG will develop the first 1550nm high-power laser with a fiber-coupled power of 150mW using an integrated laser MOPA, fabricated with advanced nano-imprint lithography (NIL). The 150mW delivered will enable a modular architecture, with pump sharing among 3 integrated silicon lasing cavities, for 3-axis sensing. The single-step NIL process enables fast wafer scale patterning and ensures low-cost and high-volume laser production. Finally, MERMIG will bring together photonics and electronics on a fully-functional opto-electronic gyroscope system prototype characterized according to ASTRIUM testplan procedures. MERMIG will deliver to ASTRIUM a new generation gyroscope that will weigh

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**NBR: 313116** **ACRONYM: NANOSAT** **EC FUND: 498216**

**DG:** REA **Call: FP7-SPACE-2012-1** **Thema:** SPA.2012.3.5-01

**Title:** Utilizing the potential of NANOSATellites for the implementation of European Space Policy and space innovation

**Abstract:** Current project has focused on investigating opportunities, how nanosatellites could be used to support the implementation of European Space Policy. Nanosatellites serve to be cost-effective science and technology platform to make sustainable contribution to a roadmap for space and innovation in Europe, which includes realizing a potential of new and innovative space applications and stimulating an evolvement of new business models for space missions. In that regard, the NANOSAT project brings together partners from nanosatellite development network in Europe to create the opportunities for continuous and sustainable collaboration between nanosatellite players, furthering the advancement of nanosatellite platform, development of innovative space applications and sharing the knowledge base with each other. The main objective of the NANOSAT project is to contribute to a roadmap for space and innovation in Europe through studies and events in support of highly capable small satellites and thereby innovative space applications and new business models for space missions in Europe. In order to reach to desired impact, the NANOSAT project has defined the following specific objectives: • Consolidate main actors in European nanosatellites landscape by creating functional network, showcasing best practices and potential markets to serve the objectives of European Space Policy; • Demonstrate nanosatellites potential in Europe by proposing innovative services which will complement and create synergy with GMES services by addressing information needs faster and more flexibly; • Draw “proof of concept” missions that will realize the ability of nanosatellites to perform missions like communications and Earth observation in support of European Space Policy.

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**NBR: 313642** **ACRONYM: LASI** **EC FUND: 1453748**

**DG:** ERCEA **Call: ERC-2012-StG_20111124** **Thema:** ERC-SG-SH2

**Title:** Law, science and interests in European policy-making

**Abstract:** This project provides a detailed analysis of how European law structures the use of different types of expertise in European policy-making, and assesses whether and to what extent objectives such as ensuring scientific expertise, sound evidence and interest representation overlap or are in tension with each other. However, European law constitutes a particular social subsystem, a cognitive framework and a form of expertise. While law is expected to deliver the regulatory framework through which different types of expertise are incorporated into European policy-making, it is itself framed through a process in which different types of expertise play a role. This research project has therefore two objectives. Objective 1: Mapping and critically assessing the European legal framework that structures different types of expertise in European policy-making.

Objective 2: Analysing how European law functions as a social subsystem and assessing how legal expertise functions in relation to other forms of expertise in European policy-making. While the project is inspired by legal theory, and in particular systems theory and reflexive law theory, it employs an interdisciplinary methodology ensuring a detailed empirical enquiry based on legal analysis, semi-structured elite interviews, process tracing of adopted policy measures, and network analysis. The project focuses on three policy areas that feature very different modes of European governance, namely nano-technology, employment, and competition policy.

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**NBR: 313978** **ACRONYM: IASS** **EC FUND: 2397266**

**DG:** RTD **Call: FP7-AAT-2012-RTD-1** **Thema:** AAT.2012.3.4-2.

**Title:** IMPROVING THE AIRCRAFT SAFETY BY SELF HEALING STRUCTURE AND PROTECTING NANOFILLERS

**Abstract:** Inspection and Maintenance are important aspects when considering the availability of aircraft for revenue flights. Modern airframe design is exploiting new exciting developments in materials and structures to construct ever more efficient air vehicle able to enable 'smart' maintenance including self-repair capabilities. The improvement in the aircraft safety by self-healing structures and protecting nanofillers is a revolutionary approach that should lead to the creation of novel generation of multifunctional aircraft materials with strongly desired properties and design flexibilities. In recent years, the development of new nanostructured materials has enabled an evolving shift from single purpose materials to multifunctional systems that can provide greater value than the base materials alone; these materials possess attributes beyond the basic strength and stiffness that typically drive the science and engineering of the material for structural systems. Structural materials can be designed to have integrated electrical, electromagnetic, flame resistance, regenerative ability and possibly other functionalities that work in synergy to provide advantages that reach beyond that of the sum of the individual capabilities. Materials of this kind have tremendous potential to impact future structural performance by reducing size, weight, cost, power consumption and complexity while improving efficiency, safety and versatility. Actually, also a very advanced design of an aircraft has to take required inspection intervals into account. An aircraft with inherent protective and smart abilities could help to significantly extend the inspection intervals, thereby increasing aircraft availability. The main objective of this EASN endorsed proposal is to develop and apply a multifunctional autonomically healing composite for aeronautic applications. The multifunctional composite systems will be developed with the aim of overcoming serious drawbacks of the composite materials.

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**NBR: 314159** **ACRONYM: NECOBAUT** **EC FUND: 2121013**

**DG:** RTD **Call: FP7-2012-GC-MATERIALS** **Thema:** GC.NMP.2012-1

**Title:** New Concept of Metal-Air Battery for Automotive Application based on Advanced Nanomaterials

**Abstract:** The aim of NECOBAUT Project is to develop a new concept of battery for automotive based on a new metal/air technology that overcomes the energy density limitation of the Li-ion battery used at present for Electrical Vehicles. Some metal/air cells were developed in the past, but did not give the demanded requirements for commercial use. Two decades of improvements in materials for electrodes, electrolytes and batteries and mainly in nanomaterials have helped for developing a battery that should fulfil the requirements of the car industry. The technology that is developed in the project addresses mainly the design and manufacturing of both electrodes of the battery: the negative electrode composed by the selected metal, and the air cathode with the catalyst supported on a carbonaceous material. Air is necessary for running the battery and allows having a very light battery, which is essential for the automotive industry. Another important advantage is the low cost of the materials used for manufacturing the battery: the selected metal, carbon support electrode and potassium hydroxide as electrolyte. All these materials are recyclable. The consortium is composed of 8 partners (3 IND, 2 Universities and 3 RTD) covering the complete value chain: battery manufacturer, nanomaterials development (i.e.; nanocatalys, additives and support materials such us carbon), modelling and simulation for cells and batteries design, scaling-up, safety and risks studies for batteries. A proof-of-concept metal/air cell is manufactured and tested in the project. In addition, the battery concept is validated for automotive application. Although the main market for the battery developed by NECOBAUT is the car industry, it could be also used for stationary electricity storage (photovoltaic and wind farms, and buildings).

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**NBR: 314212** **ACRONYM: NANO-HVAC** **EC FUND: 2850000**

**DG:** RTD **Call: FP7-2012-NMP-ENV-ENERGY-ICT-EeB** **Thema:** EeB.NMP.2012-4

**Title:** Novel Nano-enabled Energy Efficient and Safe HVAC ducts and systems contributing to an healthier indoor environment

**Abstract:** The NANO-HVAC project concept aims at developing an innovative approach for ducts insulation while introducing new cleaning and maintenance technologies, all enabled by cost-effective application of nanotechnology. The main concepts are: 1. Safe, high insulating HVAC-ducts enabling minimization of heat/cool losses: cost-effective, safe and extremely thin insulating duct layers that can be applied both to circular ducts (wet-

spray solutions) and to square ducts (pre-cast panel). Insulation will be obtained using sprayable aeroclay-based insulating foams that can be automatically applied during manufacturing of ducts, avoiding manual operation needed for conventional materials. Such technologies, coupled with advanced maintenance systems (objective 2) will guarantee a 50% energy saving compared with conventional ducts. 2. Cost-effective pathogen and allergenic removal during operation and maintenance to reduce microbial growth: (a) development of anti-microbial, sprayable and self-adhesive photocatalytic coating, based on titanium oxide nanoparticles, for HVAC filters. (b) Development of an injectable liquid polymer matrix (epoxy resins with polyamine derived crosslinking catalyst) containing antimicrobial nanoparticles (silver oxides) for air ducts in situ maintenance activities. The liquid polymer will polymerize in situ creating a coating of thickness< 20µm which will cover the surface trapping dirt, debris and microorganisms, thus "regenerating" the duct inner layer. The procedure may be repeated over time without affecting HVAC energy performance. Scientific and technological objectives within NANO-HVAC project can be organised in four areas: (1) high efficient and cost-effective insulation solutions for HVAC ducts (2) inhibition and removal of pathogens and allergenics (3) integration and lab scale characterization, (4) demonstration and validation. The project duration is estimated to be 36 months, with tasks organized in 9 Work Packages.

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**NBR: 314282** **ACRONYM: LISSEN** **EC FUND: 2579940**

**DG:** RTD **Call: FP7-2012-GC-MATERIALS** **Thema:** GC.NMP.2012-1

**Title:** Lithium Sulfur Superbattery Exploitating Nanotechnology

**Abstract:** This project is aimed to the identification and development of nanostructured electrode and electrolyte materials to promote the practical implementation of the very high energy lithium-sulfur battery. In particular, the project will be directed to the definition and test of a new, lithium metal-free battery configuration based on the use of lithiated silicon as the anode and a nanostructured sulfur-carbon composite as the cathode. It is expected that this battery will offer an energy density at least three times higher than that available from the present lithium battery technology, a comparatively long cycle life, a much lower cost (replacement of cobalt-based with a sulfur-based cathode) and a high safety degree (no use of lithium metal). All the necessary steps for reaching this goal are considered, starting from material synthesis and characterization, exploiting nanotechnology for improving rate capability and fast charging, the fabrication and test of large scale prototypes and to the completion of the cycle by setting the conditions for the recycling process. A team of experts have been selected as partners of the project, including a number of academic laboratories, all with worldwide recognized experience in the lithium battery field, whose task will be that of defining the most appropriate electrode and electrolyte nanostructures. The project will benefit by the support of a laboratory expert in battery modeling to provide the theoretical guidelines for materials'

optimization. Large research laboratories, having advanced and modern battery producing machineries will be involved in the preparation and test of middle size battery prototypes. Finally, chemical and battery manufacturing industries will assure the necessary materials scaling-up and the fabrication and test of large batteries and particular attention will be devoted to the control of the safety and to definition and practical demonstration of its most appropriate recycling process.

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**NBR: 314345** **ACRONYM: PLAST4FUTURE** **EC FUND: 6000000**

**DG:** RTD **Call: FP7-2012-NMP-ICT-FoF** **Thema:** FoF.NMP.2012-7

**Title:** Injection Moulding Production Technology for Multi-functional Nano-structured Plastic Components enabled by NanoImprint Lithography"

**Abstract:** Micro- and nanometer structuring has proven to be an efficient method to functionalize surfaces, and is attractive to manufacturers of plastic products. Plastic components are volume manufactured by injection moulding. Compact Discs and Digital Video Discs are today manufactured with nanometer range lateral resolution but, only on planar surfaces. Free-form (double-curved) moulding tools today offer resolutions down to 100 µm, limited by the methods used for creating the injection moulding tools. The objective of the project is to upgrade existing injection moulding production technology for manufacture of plastic components by enhancing the lateral resolution on free-form surfaces down to micro- and nanometer length scales. This will be achieved through the development of a complete nanoimprint lithography solution for structuring the free-form surface of injection moulding tools and tool inserts. This will enable a cost effective and flexible nanoscale manufacturing process that can easily be integrated with conventional mass production lines. The proposed technology enables functionality of plastic surfaces by topography instead of chemistry. This will significantly simplify the introduction of new products to the market, safer to produce and use. The proposed technology allows production of plastic surfaces with several different functionalities using the same material. This simplifies recycling and supports a cradle-to-cradle production philosophy. The proposed technology will be developed to meet specific industry demands from partners representing the plastic industry including the automotive, lighting and toy industries. During the project the European Trade Organisation representing the European plastic industry will disseminate the PLAST4FUTURE technology towards inter-sectoral end-users. An OEM service, provided by participating SMEs and Large Enterprises, will be established to secure a lasting value supporting European competitive strength.

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**NBR: 314463** **ACRONYM: LORRY** **EC FUND: 2392547**

**DG:** RTD **Call: FP7-SST-2012-RTD-1** **Thema:** GC.SST.2012.2-1.

**Title:** Development of an innovative low rolling resistance truck tyre concept in combination with a full scale simulation tool box for tyre performance in function of material and road parameters

**Abstract:** The aim of the LORRY project is to reduce trucks carbon footprint by developing an innovative low rolling resistance tyre concept combined with a comprehensive tool box for fleet fuel saving management. This proposed concept will go beyond current state of art and stakeholder or market expectations regarding tyre rolling resistance, mileage, driving safety, driving performance and material and manufacturing sustainability. Steer and trailer tyres developed in the framework of the project will demonstrate a minimum 20% gain in truck tyre rolling resistance. Truck tyre wear and wet safety performance levels will be improved additionally. To reach this objective, a multidisciplinary consortium (7 public / 4 private partners) has been created covering the fields of tyre technology, rubber and filler technology, nanotechnologies, composite physics, sensory, transport and road infrastructure. A complete set of complementary scientific evaluation methods will enable the understanding of interactions between new tread pattern design and new material composites as well as the tyre performance dependency on tyre-vehicle operation and road conditions. LORRY consists in a holistic approach for an intelligent surface transport system. New tyre and truck fleet operating concepts resulting from the programmed will go beyond European Green Car Initiative roadmap expectations for 2015 and smoothly bridge and feed next coming tailored trucks and sustainable trucks initiatives, forecasted respectively for 2020 and 2025.

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**NBR: 314582** **ACRONYM: EFEVE** **EC FUND: 4900000**

**DG:** RTD **Call: FP7-2012-NMP-ICT-FoF** **Thema:** FoF.NMP.2012-7

**Title:** Development of a new high performance material associated to a new technological Energetic, Flexible, Economical, Versatile and Ecological process to make super strong and lightweight components

**Abstract:** The general objective of EFEVE project is the improvement of the new technologies to manufacturing of materials (aluminium and magnesium alloy) and processes and new technologies of production that are more energy efficient, improve manufacturing productivity, optimize raw material consumption, flexible mold changes and manufacturing capability of producing multiple components, ...etc. The development made in the EFEVE project aim at reducing the energy consumption of up to 20% compared with current systems. To reach these objectives, we will first investigate innovative new manufacturing alloy and new materials (SP3). The first one will be add nano-reinforcer to aluminium and magnesium alloy, the second technologies gives a mixing nano-reinforced and their characterization. This method also has a potential to

improve the metallurgical quality and reduce the quantity of residues and low of cost of materials. The research and the developments of the project will take into account the EU policies for Eco design, therefore the following parameters will be considered, in addition to those related with the working conditions (temperature, pressure, melted material flow, etc..)).

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**NBR: 314648** **ACRONYM: ENE-HVAC** **EC FUND: 2904904**

**DG:** RTD **Call: FP7-2012-NMP-ENV-ENERGY-ICT-EeB** **Thema:** EeB.NMP.2012-4

**Title:** Energy efficient heat exchangers for HVAC applications

**Abstract:** In residential and commercial buildings, Heating, Ventilation, and Air Conditioning (HVAC) systems constitute about 35% of the total energy consumption. Although today, heating is the most energy demanding need, there is an increasing demand for cooling which is expected to increase even further in the years to come due to climate changes. To decrease the overall energy demand, it is vital to look for new and innovative technologies for increasing the efficiency of currently applied state-of-the-art HVAC systems. To efficiently tackle the need for less energy demanding HVAC systems for both residential buildings and commercial facilities, the overall focus of EnE-HVAC focus will be on the energy efficiencies heat transfer addressing on both the air side- and the refrigerant side of the systems. It will also, importantly, tackle the energy transportation within the system to ensure maximum efficiency. This will require very high performance characteristics of the refrigeration agents in use. To ensure a significant impact on global warming, there will be a focus on developing the use of coolants with no HFC and CFC content. The specific aim of EnE-HVAC is to facilitate a significant reduction of the total energy consumption in modern HVAC systems by combining a range of new nanotechnological solutions. There will be a clear focus on the optimization of the heat transfer of heat exchangers used in HVAC systems such as condensers and evaporators in HVAC systems, along with the design of systems and the development of new nanomaterial enhanced HFC and CFC free refrigerants. The culmination of the present project will be the demonstration of energy savings of up to 50% on the total energy consumed in the developed HVAC systems compared current to state-of-the-art commercial systems. The EnE-HVAC consortium comprises industry market leaders representing the value chain and leading research institute in surface technology and heating/cooling.

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**NBR: 314701** **ACRONYM: NANOCOOL** **EC FUND: 3250000**

**DG:** RTD **Call: FP7-2012-NMP-ENV-ENERGY-ICT-EeB** **Thema:** EeB.NMP.2012-4

**Title:** An Energy Efficient Air Conditioning systems with Temperature and Humidity independent controls based on the combination of a Liquid Desiccants Cycle with an adapted conventional air cooling system

**Abstract:** Air-conditioning is a rapidly growing electrical end-use in EU. A/C systems reduce temperature of the ambient air while removing humidity. However such combined air conditioning/dehumidification is generally inefficient. A promising approach is represented by Hybrid Liquid Desiccant (HLD) systems, where the latent load is removed by a liquid desiccant dehumidifier, while the sensible load is removed by a conventional vapor compression air cooler. The heat required for regeneration of the liquid desiccants needs however to be provided by outer sources like natural gas or solar collectors. Furthermore almost all metal alloys are corroded by the most effective liquid desiccants. HLD systems are therefore not penetrating the market. Our goal is to develop an innovative HLD system in the range 100-200 kW, where waste heat from the condenser is used for regeneration of the desiccants. The energy demand by this process is 55% of the conventional technique. In cases of severe humid environments, like swimming pools, or kitchens, the energy savings can achieve easily levels of 65%-70%. Several innovative components have to be developed, namely: - Two multifunctional heat exchangers with high corrosion resistance for either water vapour absorption from the air flow or desiccant regeneration; - Development of a liquid-liquid heat exchanger with high corrosion resistance for desiccant regeneration process pre-heat (liquid-liquid desiccant). Based on the promising results of the FP7 Thermonano project, thermally conductive polymer nano-composites will be considered as material for these components and shaped into innovative engineered heat exchange surface. The partners foresee an initial market worth up to 180 MEuro by 2020, generating/maintaining 4000 job opportunities for skilled operators and installers. The partners expect that the intended HVAC solution will allow cumulative savings on energy bill of at least 60 MEuro with a pay-back time below 2 years in case of 50% use.

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**NBR: 314988** **ACRONYM: SELFCLEAN** **EC FUND: 1139000**

**DG:** REA **Call: FP7-SME-2012** **Thema:** SME-2012-1

**Title:** Novel Self-cleaning, anti-bacterial coatings, preventing disease transmission on everyday touched surfaces

**Abstract:** Hygiene/antimicrobial issues in public places (hospitals, schools, hotels, public transportation etc) are of crucial importance as inattention could lead to spread of viral diseases or epidemics and consequently to deaths. A typical example is that of hospital acquired infections (HAI). According to The European Centre for Disease Prevention and Control (ECDC) in the EU, about 3,000,000 are infected annually with HAI and about 25,000 patients die from this. Such infections also bring extra healthcare costs and annual productivity losses of at least €1.5 billion. It is estimated that 15% of these

infections is due to transmission through inanimate objects. Although sanitization and disinfection of surfaces using chemical liquids as chlorine or alcohol is a common practice to prevent transmission of diseases, many times such procedures are skipped, skimped or in the case of public transportation not practically feasible. There exists a great need for anti-bacterial/viral surfaces to reduce the spread of diseases. The SMEs of the consortium having identified this need propose the solution of self-cleaning, antibacterial electrolytic coatings of high aesthetics and durability. These composite coatings will consist of Sn-Ni matrix with doped TiO2 nanoparticles as a reinforcing mean. Doped-TiO2 nanoparticles having the ability to absorb visible light can be activated indoors and thus present enhanced photocatalytic activity. The incorporation of these doped-TiO2 nanoparticles in the Sn-Ni matrix will have as a result the self-cleaning and antibacterial properties. Of crucial importance is the percentage of the incorporated nanoparticles. In order to increase the co-deposition rate and consequently the photocatalytic activity, pulse current plating will be utilized. With this method higher co-deposition rate of nanoparticles can be achieved compared to the conventional direct current plating. These kind of coating will be able to operate under indoor light irradiation and can be applied to common touched objects (knobs, taps, handles) reducing the risk of infection's transmission by 50-100%.

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**NBR: 315019** **ACRONYM: INNOVTEG** **EC FUND: 1290979**

**DG:** REA **Call: FP7-SME-2012** **Thema:** SME-2012-1

**Title:** An innovative very low-cost thermo-electric technology for large-scale renewable solar energy applications.

**Abstract:** The aim of the INNOVTEG project is to create nano-structured thermo-electric materials based on (low cost and abundant) sulphur with carefully controlled structure and properties. By doing this our consortium will create a step-change in the application of thermo-electric technologies for large-scale solar renewable applications in the EU by developing thermo-electric at massively reduced cost (€5.20/kg). The technologies developed will be particularly suited to building integrated renewable systems. This will enable us to create a very low-cost thermo-electric system suitable for building integration that can achieve an output of ~30Wp/sq.m and a power generation cost of €533/kWp (significantly less than the corresponding cost of ~€3,000/kWp for PV systems) across a range of European climatic conditions. In so doing, the InnovTEG technology will offer greatly improved environmental performance due to improved reduced dependence on fossil fuels, reduced emissions (CO2, nitrogen oxides, hydrocarbons, carbon monoxide and particulates) at a cost that is affordable to the end-user. It is expected that the InnovTEG project will generate ~€200m million business growth for its SMEs within a 5 year period creating more than 171 jobs. The project results are expected to benefit other SMEs in the renewable energy, materials processing and electronics industry sectors. In addition, the technology has the

capability to reduce CO2 emissions by 208,000 tonnes of CO2 per year 5-years post-project.

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**NBR: 315041** **ACRONYM: AVCOP** **EC FUND: 1059000**

**DG:** REA **Call: FP7-SME-2012** **Thema:** SME-2012-1

**Title:** Added-value for metallic coated products by new sol-gel process

**Abstract:** The AVCOP project (added-value for metallic coated products by new sol-gel processes) proposes to enable seven small manufacturing enterprising companies to re-define the product offer in the market for metal-finishing applications. The proposal seeks to combine nano-structured sol-gel coatings with ionic liquids for the first time to seal and protect anodised aluminium, hot-dip-galvanised steel and electroplated zinc. The traditional manufacturing sectors are experiencing significant threat from cheaper, low-quality and low-cost imports from lower cost economies. In the spirit of Europe 2020, the SME's aim to respond through the exploitation of innovative surface treatments to offer the market levels of wear-resistance, corrosion protection and aesthetic appearance that exceed the best standards available today. The SME's aim to derive significant benefits for their manufacturing processes by reducing the energy input for the anodising process by 50%, the elimination of all toxic pre-treatments from the galvanising process and the use of nano-structured, ionic-liquid-enabled coating systems, that will be entirely solvent-free. The SME consortium is drawn from member states from the four poles of the EU compass presenting a perfect representation of the developmental span for EU member states. All of the SME's have experienced challenges through product substitution or replacement from inferior–quality imports and aim to respond proactively by drawing the leading research performers in the field of sol-gel chemistry for corrosion and wear protection and the emerging chemistry of ionic liquids

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**NBR: 315195** **ACRONYM: NANOFLOC** **EC FUND: 1141968**

**DG:** REA **Call: FP7-SME-2012** **Thema:** SME-2012-1

**Title:** Electro-agglomeration and separation of Engineered NanoParticles from process and waste water in the coating industry to minimise health and environmental risks

**Abstract:** The rapid introduction of nano-based products into the market has caused a major concern both for health and environmental impacts, among others from the paint and coating business. A number of studies have documented health risks related to nanoparticles, inhalation exposure and dermal contact being main exposure routes in

the coating and paint industry. Likewise, discharge of nanoparticles into aquatic environment causes damage to the gill membrane of fish and crustaceans. Today, the only effective means of removing nano-particles from water is application of energy intensive methods such as reverse osmosis. Therefore, the coating industry that uses products with nanoparticles needs a cost effective technology for removing them from used water. The proposers of NANOFLOC have thus identified a new market opportunity in developing a novel electro agglomeration technology for removing nanoparticles entrained in water. The technology is cost effective, compact and nvironmentally friendly. It is based on destabilisation of nano suspensions and agglomeration of charged particles in solutions using electric fields and flocculation in one step, avoiding addition of chemicals. The objectives of NANOFLOC will be attained by development of innovative reactor for agglomeration and stabilisation of flocs, superior hydraulic design of a reaction chamber and creation of intelligent process control system (PCU). The RTD work is structured in 5 of 8 WPs: In WP1, a life cycle analysis will be undertaken to provide a benchmark for the development program. Scientific characterisations of the process and development of parameters will be performed in WP2. Design and configuration development of the reactor will be carried in WP3. The PCU will be developed in WP4. The NANOFLOC system will be integrated and tested in WP5. Demonstration activities and dissemination of results will be carried out in WP6 and WP7 respectively, while project management tasks will be included in WP8.

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**NBR: 315233** **ACRONYM: N-CHITOPACK** **EC FUND: 901096**

**DG:** REA **Call: FP7-SME-2012** **Thema:** SME-2012-1

**Title:** Sustainable technologies for the production of biodegradable materials based on natural chitin-nanofibrils derived by waste of fish industry, to produce food grade packaging

**Abstract:** The food sector (including beverage industry) accounts for approximately two thirds of global packaging and about 50% of these packages are made of plastics. Plastic food packaging materials currently in use are generally non-biodegradable causing ecological imbalance and aesthetic deterioration of nature. At the same time being a petro-chemical based product, plastics rely on a depleting and increasingly costly natural resource with relatively low LCA performance (high CO2 footprint). Food packaging – which is predominantly produced by SMEs - is crucial as physical and barrier protection keeping foodstuffs clean, fresh, and safe for consumers while increasing shelf life. Bio-based plastics offer a highly promising alternative and new biological materials are emerging as potential feedstock, such as chitin waste material from the fishing industry, mostly used in cosmetics applications due to their inherent bacteriostatic properties. Chitin waste exceeds 250 billion tons/year, and is considered hazardous due to its high perishability and polluting effect, both on land and sea. So re-use and up cycling to higher value applications would establish an important step forwards towards resource efficiency, providing a relevant innovation for the SME packaging industry that is under

pressure to reduce cost and respond to environmental concerns. Recent research results at the University of Prague, leveraging on an SME owned world-wide patent (MAVI) for the production of chitin Nano fibrils, show interesting additional application opportunities of chitin as a bio-based polymer. The n-CHITOPACK project will leverage on the inherent superior properties of these chitin nano-fibrils for the development of new food packaging materials that are bacteriostatic, 100% bio-degradable and can be used by European packaging SMEs, contributing to increase their competitiveness in the market and to solving environmental challenges.

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**NBR: 315239** **ACRONYM: ADEC** **EC FUND: 1197000**

**DG:** REA **Call: FP7-SME-2012** **Thema:** SME-2012-1

**Title:** Advanced Low Friction Engine Coating

**Abstract:** The consortium behind this project – a group of European SMEs, surface coating technology providers and engine manufacturers – aims at developing a new innovative type of super lubrication wear-resistant surface coating for internal walls within internal combustion engines. The coating will reduce friction and provide better tolerances between cylinder and piston, decrease the wear of the components, increase the fuel efficiency, increase the engine power as well as increase the overall engine lifetime, reduce the CO2 emissions and even reduce the overall pollution of e.g. soot particles and formation of NOx. A new coating embedded with nano-diamond will be developed and tested. The AdEC project will initially target primarily the small engine market with 2-stroke and 4-stroke engines, it is foreseen that there will be a significantly larger market in connection with conventional car engines after successful implementation in small engines. The implementation of AdEC will therefore open up a significant market potential for the SME consortium, targeting an initial potential market of € 650 million.

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**NBR: 315494** **ACRONYM: LICARA** **EC FUND: 2011689**

**DG:** REA **Call: FP7-SME-2012** **Thema:** SME-2012-2

**Title:** Life cycle approach and human risk impact assessment, product stewardship and stakeholder risk/benefit communication of nanomaterials

**Abstract:** Nanomaterials have a great market potential for SMEs due to the high added values and the reduced batch sizes compared to their corresponding conventional bulk materials. Unless the benefits the introduction of nanomaterials is hampered due to the unknown human and ecological risks. It may take many years to fill all knowledge gaps. However, the SMEs have to address the various different aspects and perceptions of risks, in

communication with the various stakeholders. For this reason, SMEs need guidance to assess the risks and the benefits of their nanoproducts in comparison with the conventional (non-nano) products. The main goal of this project is to develop a structured life cycle approach for nanomaterials that (1) enables to balance health/environmental risks of nanomaterials in view of paucity of data against their benefits and (2) that further allows a comparison with the risks and the benefits of the conventional (non-nano) products. This structured approach will be the base for a completely new service available to SMEs working with nanomaterials. As proof of principle and concrete benefit for the SMEs, LICARA will deliver guidelines to the members of the SME Associations to support them in their communication with regulators, clients and investors and to improve the production processes and/or applications of their specific nanoproducts. The consortium consists of 1 European and 3 national SME Associations, 2 SMEs, 3 RTDs and 1 project services company. The consortium is built in a way that the needed different expertise is represented. The partners are active in a range of (inter)national initiatives such as FP7 projects on life cycle assessment and risk assessment, OECD, ISO and CEN.

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**NBR: 315548** **ACRONYM: ICECLAY** **EC FUND: 948885**

**DG:** REA **Call: FP7-SME-2012** **Thema:** SME-2012-1

**Title:** Highly efficient production of ultra-lightweight clay-aerogel materials and their integrated composites for building insulation

**Abstract:** 40% of energy consumption and 36% CO2 emissions in Europe are directly related to the buildings due mainly to inefficient insulation materials and systems. Currently required insulation performance may only be achieved either by installing extremely thick ordinary insulation materials and sacrificing living spaces or by using unaffordable the state-of-the-art insulation materials (e.g. silica aerogel). Of European building sector, more than 99% are SME and buildings construction market reached over 1 trillion equivalent to about 9% of European GDP, representing a total workforce of 25 million jobs. The ICECLAY project aims at creating a new generation of low cost and most efficient insulation materials for EU building construction and hence enhancing the competitiveness of SMEs in EU construction sector. The project is to develop nano-structured ultra-lightweight clay-aerogel and its integrated composites by using harmless and inexpensive nano-scale minerals, water and eco-friendly or soluble/dispersible low-cost polymers, through innovative and cost effective freeze-drying processes. The ICECLAY will provide, due to their extremely porous structure and reduced thickness, the superior thermal insulation specially designed for highly energy efficiency building's retrofit and advanced HAVC systems. The developed innovative thin and flexible lightweight ICECLAY board and film will claim to be an excellent and cheaper alternative to the unaffordable high-performance insulation materials like the space oriented supercritical-dried silica aerogel and vacuum insulation panels. The developed

powder based ICECLAY will be used as superior enhancing thermal insulation fillers for a broad range of building products like concrete, drywalls, bricks, plasters and coatings.

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**NBR: 315586** **ACRONYM: LUNGCARD** **EC FUND: 1056000**

**DG:** REA **Call: FP7-SME-2012** **Thema:** SME-2012-1

**Title:** Point-of-care blood device for fast and reliable prediction of drug response in non-small-cell lung carcinoma patients from blood samples

**Abstract:** Chemotherapy is the standard care for the treatment of non-small cell lung carcinoma (NSCLC) patients, however most of non-small cell lung cancer tumours are not sensitive to this treatment. As an alternative to chemoterapy, target therapy with gefitinib (epidermal growth factor receptor-tyrosine kinase inhibitor) has been used in clinical practice in patients with tumours harbouring mutations in EGFR gene, improving their treatment effectiveness. For that reason EGFR mutations analysis should be perform to support the treatment decision for a patient with NSCLC. Despite all the foreseen benefits of EGFR genotyping, the current PCR-based methods used have been shown some associated bottlenecks: i) use of complex samples (tumour biopsy embedded in Formalin Fixed Paraffin, FFPE), ii) require a better understanding from the clinical geneticist to accurately interpret the information provided and to setup the best line of therapy and treatment and iii) the assays are quite expensive and time-consuming. New age diagnostic tools, such as microfluidic platforms and nanodiagnostics are emerging technologies for DNA analysis requiring lower sample volumes and providing comparable sensitivity and specificity at lower costs. Nonetheless, sample preparation and detection of the result of a chemical analysis on-chip are still weak points in many lab-on-a-chip devices. The current proposal, aiming the integration of “all laboratory-based process steps” in one single step, is both challenging and feasible: development of a microfluidic chip that combines blood sample processing (DNA extraction/purification, multiplex amplification) and detection of EGFR mutations in tumour DNA by means of gold and silver-nanoparticles (Ag and Au-nanoprobes). Furthermore a microfluidic chip analyser with an integrated user-friendly software to report genotyping results will be developed.

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**NBR: 315592** **ACRONYM: HOT-WIRE** **EC FUND: 1211998**

**DG:** REA **Call: FP7-SME-2012** **Thema:** SME-2012-1

**Title:** System to significantly increase the effective yield of Calcium (and other alloying elements) in the treatment of specialty steels, while reducing impurities in the melt.

**Abstract:** Hotwire aims to develop a new, specially coated feed wire and dispensing system that is able to delay initial Ca core exposure from current duration of only 1.5 seconds to ~5 seconds, extend the Ca melt time (once exposed) from

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**NBR: 315677** **ACRONYM: NANOPHOSOLAR** **EC FUND: 1928675**

**DG:** REA **Call: FP7-SME-2012** **Thema:** SME-2012-2

**Title:** Innovative, environmentally friendly nanophosphor down converter materials for enhanced solar cell efficiency that will reduce energy production costs and increase cell lifetime.

**Abstract:** The NanoPhoSolar project aims to overcome the limitations relating to the efficiency and performance of a range of photovoltaic (PV) systems by developing a transparent NanoPhosphor down converting material capable of absorbing Ultra Violet (UV) and short wavelength visible light and re-emitting in the more useful longer wavelength visible spectrum(range 525-850nm). This will enable the efficiency of Photovoltaic (PV) cells to be increased by an additional 10% for silicon PV and ≥25.8% for Cigs or cadmium telluride PV and potentially increase system lifetime. By doing this, the PV system created will offer greatly improved environmental performance due to capture of a larger proportion of the incident visible spectrum. This will lead to significant economic and societal benefits to consumers and manufacturers. The SME consortium target a total in-process coating technology market penetration of 5.5% when applied in the manufacturing process and 0.25% when as applied to existing installed PV systems within a 5 year period post project, achieving direct annual sales of over €66 million, ~470 new jobs and annual CO2 emissions savings of 154,697 tonnes per annum. The project results are expected to benefit other SMEs in the PV and materials processing industry sectors.

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**NBR: 315679** **ACRONYM: IMCOSS** **EC FUND: 1443000**

**DG:** REA **Call: FP7-SME-2012** **Thema:** SME-2012-1

**Title:** Injectable Medical Ceramics for Bone Repair and Augmentation

**Abstract:** The repair and regeneration of bone tissue remains a significant clinical challenge in many clinical fields including orthopaedics, dentistry, and maxillofacial surgery. The problem is increasing in the face of complicating factors such as the ageing population. The aim of this project is to undertake a basic scientific study of new nanostructured biomaterials that will underpin the development of new nanostructured, injectable bone graft substitutes. This scientific and technological research will be integrated with the

development of a dedicated advanced delivery system that will provide the surgeon with a high degree of control during clinical use. The basic scientific research will be directed at understanding structure-property relationships related to nanoparticle size and morphology, composition, and functional behaviour including rheology, biocompatibility, and bone tissue regeneration. While the project is ambitious, the likelihood of success is greatly increased by the formation of a consortium that includes different elements of the supply chain in combination with the scientific competencies necessary to execute the work programme. The scientific and technological aspects of the project will be further enhanced by the participation of a clinical panel composed of surgeons from the two RTD partner organisations. This combination of business, scientific and clinical expertise will together facilitate the translation of basic science through applied research and on to development of a new medical device.

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**NBR: 315711** **ACRONYM: APACOS** **EC FUND: 1013999**

**DG:** REA **Call: FP7-SME-2012** **Thema:** SME-2012-1

**Title:** Automated Precision Assembly for Complex Optical Systems

**Abstract:** The APACOS project aims at developing solutions for the automated assembly of laser systems. The solutions include new laser sources designed for automated assembly, as well as an industrial micro assembly system that will be mechanically enhanced by an ultra-precise micromanipulator for additional degrees of freedom. Fully automated alignment and bonding strategies for optical components will be implemented in APACOS in order to prove the production concept. Therefore, two European SMEs from the laser manufacturing industry, Modulight and Altechna R&D, will develop novel laser sources with high market potential. Altechna aims at a high-power yellow laser based on OPSL technology with perspectives in the markets of health care and life sciences. Modulight pursues the development of a single-emitter based product platform for visible green and yellow lasers used for projection and display applications. The developments will be supported by the Optoelectronics Research Centre at Tampere University of Technology, a leading European research institution in the field of laser sources. SmarAct, an SME from Germany, is provider of precision technology such as multi-axes micromanipulators with nanometer precision. In APACOS a flexure-based micromanipulator will be integrated into an industrial micro assembly system by Rohwedder Micro Assembly, a company with long year experience in developing industrial micro assembly systems and also a partner in the project. The integration will mainly be carried out by the Fraunhofer-Institute for Production Technology IPT, a leading edge research institute in the field of automated laser assembly. For the development of automated alignment and bonding processes, the consortium sets up a process prototyping station with standard equipment and easy-to-use operator interfaces. A novel control concept for the production solution aiming at a high degree of reusability of process implementations will be worked out. The participation of FISBA

OPTIK, a leading optics manufacturer from Switzerland with semi-automated assembly lines for optical sub-assemblies, completes the consortium. FISBA contributes valuable experience regarding automation-friendly component design and automated component handling. Together, the APACOS consortium strives for a more standardized and automated assembly of lasers and optical systems considering aspects of product design, production system requirements, and process development. That will lead to a set of design guidelines for laser sources and a flexible assembly cell for laser optics. The project results are expected to have a major impact on the European laser industry by strengthening innovative laser manufacturers through more competitive production conditions.

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**NBR: 315871** **ACRONYM: APT-STEP** **EC FUND: 1150921**

**DG:** RTD **Call: FP7-REGPOT-2012-2013-1** **Thema:** REGPOT-2012-2013-1

**Title:** Unlocking APTLâ€™s Scientific and Technological Research Potential in Green Mobility

**Abstract:** The objective of the APT-STEP project is to increase the research and innovation capacity of the Aerosol and Particle Technology Laboratory (APTL) of the Chemical Process and Energy Resources Institute (CPERI) of the Centre for Research and Technology Hellas (CERTH), a public non-profit research organization in the Region of Central Macedonia in Greece. Over the past decade, APTL has developed significant research result capital in the area of vehicle emissions control technologies; however, this technology area is maturing, and the automotive industry is turning to hybrid, electric and hydrogen fuel cell powertrain technologies in order to develop Green Mobility. APTL's research capital has been built on core competencies in aerosol science, nanomaterials synthesis and characterisation, and hierarchically structured porous ceramic reactor engineering, which are also the foundation of the novel solar reactor technologies which the laboratory has also developed for the production of renewable solar fuels. These core competencies are also very relevant for the development of hybrid, electric and hydrogen fuel cell technologies, and, therefore, the objective of the project is to help APTL adapt its research and innovation capabilities to the new opportunities in these areas. At the same time, the Region of Central Macedonia faces significant air quality problems due to pollutant emissions in the transport sector, and, therefore, the project aims to increase the visibility of APTL to regional SMEs and public and private stakeholders in order to promote greater technology and innovation transfer. The project involves four highly experienced European industries and research organisations (Honda R&D Europe GmbH, AVL List GmbH, Centro Ricerche Fiat and CERTAM) with the objective to exchange know-how and experience and to establish long term strategic partnerships. Furthermore, an important objective of the project is the recruitment of experienced researchers with know-how in powertrain testing, new powertrain technologies, and product development. The acquisition of a chassis dynamometer and a constant volume sampler to enable complete powertrain testing will complement

APTL's existing engine test cell, and will enable the development of new powertrain technologies from lab scale to prototype scale.

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**NBR: 316082** **ACRONYM: WATER** **EC FUND: 3934530**

**DG:** RTD **Call: FP7-REGPOT-2012-2013-1** **Thema:** REGPOT-2012-2013-1

**Title:** Winning Applications of nanoTEchnology for Resolutive hydropurification

**Abstract:** The overall objectives are: strengthening the research potential of the applicant in order to formulate a solid and long term research strategy about nanotechnology applications; increase its visibility in the ERA; determining an impact on the local economy and society through technology innovation. The focus is on the application of nanotechnology to water treatment, aiming to boost the research potential in this emerging research domain. Worldwide 1.2 billion people suffer inadequate access to clean water. Nanotechnology is expected to improve the water filtration with lower cost and energy. These are the major motivations for undertaking such an initiative – relying on the local know-how on nanotechnology – that aims to develop novel applications attracting industrial and service assets. The action includes widening of the existing research infrastructures; exchange of know-how and personnel with partners to tackle the issues of the proposed nanotech-based innovation and improve the opportunities of collaborative research; reinforcement of research staff; refinement of management capacities; innovative dissemination actions both for specialists and broader audience; development of a strategic plan for the IP. The multidisciplinary partnership includes top class scientists from UK, Spain, France, Germany and Norway, local authorities, representatives of ministerial institutions, water treatment SME and filters technology world leader company, to guarantee the effectiveness and sustainability of the Action. The nanotech filtration up-scalable to industrial production will sustain the society and the economy of the Ionic Sicily, by improving the quality of the sea water, through innovative filtration of waste water flowing into the sea, and of drinkable water in a region suffering from lack of water. The general outcome will consist in a change of the local mentality, by the affirmation of a long term vision and strategy in a common scientific and social context.

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**NBR: 316331** **ACRONYM: POLARIS** **EC FUND: 2811238**

**DG:** RTD **Call: FP7-REGPOT-2012-2013-1** **Thema:** REGPOT-2012-2013-1

**Title:** Unlocking the research potential of 3Bs Group, University of Minho, in Nanomedicine field to strengthen its competitive position at the European level

**Abstract:** 3Bs is situated in one of the most industrialised regions of Northern Portugal (PT11) where the economy is strongly based on traditional, low-tech and small family businesses. Withstanding these traditions, the group has been a lighthouse and an example on the exploitation of the regional research potential within the biomedical area. Based on interdisciplinary research where collaboration and cooperation are hallmarks of its culture, 3Bs is worldly recognised for its excellence and innovative approaches in the field of macro and microscale processing of biomaterials. The project POLARIS aims to strengthen this position of 3Bs by boosting the group activity in the field of Nanomedicine. An action plan that involve upgrading the group infrastructure with state of the art equipments for processing and characterisation of biomaterials at nanoscale as well as recruiting experienced researchers and technical staff in this field has been created and will be attained by the close cooperation with 4 leading European institutions: Chalmers University of Technology, Max Planck Institute for Intelligent Systems, University College Dublin and University of Strathclyde Glasgow. Transfer of know-how and experience between the partners will be enhanced by several events targeting scientific community but also the general public. A local SME – StemMatters is also part of the partnership since the 3Bs aims to become dynamic "innovation engine", facilitating and accelerating the transfer of innovative technology from basic research to industry. Thus, POLARIS seeks for actual implementation of the obtained results that can be a vital "bridge" to growth, competitiveness, sustainability and employment in PT11.

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**NBR: 316366** **ACRONYM: PHYCHIP** **EC FUND: 2099984**

**DG:** CNECT **Call: FP7-ICT-2011-8** **Thema:** ICT-2011.9.6

**Title:** Physarum Chip: Growing Computers from Slime Mould

**Abstract:** We will design and fabricate a distributed biomorphic computing device built and operated by slime mould Physarum polycephalum. A Physarum chip is a network of processing elements made of the slime mould's protoplasmic tubes coated with conductive substances; the network is populated by living slime mould. A living network of protoplasmic tubes acts as an active non-linear transducer of information, while templates of tubes coated with conductor act as fast information channels. The Physarum chip will have parallel inputs (optical, chemo- and electro-based) and outputs (electrical and optical). The Physarum chip will solve a wide range of computation tasks, including optimisation on graphs, computational geometry, robot control, logic and arithmetical computing. The slime mould-based implementation is a bio-physical model of future nano-chips based on biomorphic mineralisation. We envisage that research and development centred on novel computing substrates, as self-assembled and fault-tolerant fungal networks will lead to a revolution in the bio-electronics and computer industry. Combined with conventional electronic components in a hybrid chip, Physarum networks will radically improve the performance of digital and analog circuits. Taking into account the enormous and growing interest of research centres and commercial

laboratories in the recent experimental implementations of chemical, molecular and biological computers, we can predict that in the next 20-30 years, networks of slime mould mineralised and/or coated with compound substances will become a widespread commodity and a very promising component of novel information processing circuits.

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**NBR: 316432** **ACRONYM: QOCAN** **EC FUND: 96000**

**DG:** REA **Call: FP7-PEOPLE-2012-IRSES** **Thema:** FP7-PEOPLE-2012-IRSES

**Title:** Quantum optics of carbon nanostructures

**Abstract:** A scientific trend, which has emerged in recent years, is to combine the methods of quantum optics with the advances in design and preparation of various nanostructures. This innovative field of physics, arising from the achievements of modern nanotechnology, offers the possibility of both the fundamental study of light-matter interaction in unusual artificial quantum systems and the development of optoelectronic nanodevices with unique characteristics. The proposed theoretical research lies within this interdisciplinary trend and joins two different important fields of the modern physics: the first one is devoted to the quantum optics, the second deals with the carbon-based nanostructures – carbon nanotubes and graphene. The main goal of the research is to combine the efforts of four scientific teams from Britain, Iceland, Russia and Brazil in achieving the following objectives: to develop fundamentals of the interaction between carbon nanostructures and quantum light, to reveal and analyse various quantum-electrodynamics effects in carbon nanostructures, and to create a theoretical basis for using carbon nanostructures as elements of novel optoelectronic nanodevices.

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**NBR: 316494** **ACRONYM: DESTINY** **EC FUND: 3848961**

**DG:** REA **Call: FP7-PEOPLE-2012-ITN** **Thema:** FP7-PEOPLE-2012-ITN

**Title:** DyE SensiTized solar cells wIth eNhanced stabilitY

**Abstract:** The DESTINY initial training network will tackle major challenges in the development of stable dye-sensitized solar cells, DSC. DSC offer exciting possibilities for applications in building integrated photovoltaics and consumer electronics. However they possess a complex structure with disparate materials. For DSC to be marketable and to compete with its inorganic counterparts, fundamental science has to be done to understand the causes of degradation and find ways of enhancing cell and module life time and stability without sacrificing performance and scalability. Eleven internationally leading European research groups from six countries [including Dyesol UK, part of Europe's leading

industrial supplier of DSC, Dyesol] have joined forces as full participants with a commercial associated partner, combining expertise in synthetic chemistry, spectroscopy, nanoscale physics and device engineering. Our highly integrated approach to understanding degradation causes and proposing solutions will take a major step towards the commercialization of DSC. This consortium is strongly committed to promote breakthroughs at the frontiers of science and engineering. The training dimension of DESTINY is reflected in the high priority we give to the training of early stage and experienced researchers, ESRs and ERs, through education and knowledge dissemination via Tutorial Courses, Annual Network Meetings, Training Schools, Conferences and Mobility Programmes. The network, with a strong focus on interdisciplinary training, builds on fruitful collaborations between the partners. Development of complementary skills (presentation, management, technology transfer, IP protection) will take place throughout the project lifetime. Interaction with stakeholders beyond those involved primarily in research will be maintained to enhance the international and societal dimension of our research and provide the wider community with information on this new technology.

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**NBR: 316513** **ACRONYM: EURO-DOTS-2** **EC FUND: 346000**

**DG:** CNECT **Call: FP7-ICT-2011-8** **Thema:** ICT-2011.3.1

**Title:** European Doctoral Training Support in Micro/Nano-electronics

**Abstract:** This proposal is submitted to support and ensure continuation of the EURO-DOTS initiative, that was launched as a Support Action in response to the FP7-Call 5 and that has successfully realized all the objectives resulting in the installation of a virtual platform to serve the Doctoral Schools in Europe in micro/nano-electronics. When the present 2-year EURO-DOTS project ends on 30 April 2012, it will not only have a fully operational platform and system in place, but it will also have realized the build-up of a course portfolio of nearly 50 PhD course titles, offered and organized by universities all over Europe. The major objective of EURO-DOTS was to improve the offering and quality of training provided to European PhD students in the micro/nano-electronics area based on the comprehensive analysis of university offering and industrial needs. One week intensive courses help them fulfilling the requirements for ECTS credits imposed by European universities for obtaining the PhD degree in Engineering. Essential in this endeavor are the scholarships that PhD students can apply for. This boosts the mobility of students but most importantly, it allows them to attend the right course at the right place, where the expertise on the treated subject is guaranteed. The major objective of this EURO-DOTS-2 follow-up project with a 2 year duration, is to ensure the continuation and continuity of the present successful action. This implies maintaining and improving operation of the platform, managing course portfolio and planning, stimulating development and submission of new courses in response to the needs of industry and researchers, managing and attributing of scholarships for PhD students and promotion

of platform service and course offering. The present partnership, installed committees and organization will be basically retained. This continuity can be realized with a limited but indispensable budget of which half will be used for the scholarships.

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**NBR: 316526** **ACRONYM: EUROTRAINING** **EC FUND: 1043036**

**DG:** CNECT **Call: FP7-ICT-2011-8** **Thema:** ICT-2011.3.1

**Title:** Provision of a European Training Infrastructure

**Abstract:** The objective of the EuroTraining proposal is to provide a European Training Infrastructure facilitating the provision of high calibre training across Europe. The structure will support professional advancement training as well as academic training. Professional course providers will get a central place for the presentation of their training offer while academics will get a course material exchange service targeting graduate nanoelectronics schools. The training action will enhance the development of the European knowledge-based society in the field of nanoelectronics. The proposal strongly builds on key building elements from the former EuroTraining project (ICT-211806), however extended with new innovative services, like: - Thematic courses supporting the convergence of advanced More-than-Moore elements with Beyond-CMOS devices - A European platform for multimedia based training - A training material exchange service for graduate schools - A global action offering training support for EU enterprises having operations in Far East - A European wide dissemination of training originating from FP7 projects (IP/NoE/STREPS) - Four new Train-the-Trainers courses for Eastern European universities All services offered will be gathered in the European Training Infrastructure web site, having 12.000 subscribers and more than 1.2 million annual users.

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**NBR: 316527** **ACRONYM: C4R** **EC FUND: 42910**

**DG:** REA **Call: FP7-PEOPLE-2012-NIGHT** **Thema:** FP7-PEOPLE-2012-NIGHT

**Title:** CRAZY FOR ROCKING RESEARCHERS

**Abstract:** It’s now very clear how much Genoa and Liguria need to reinforce the researchers role, especially after the 2010 Researchers Night edition. The C4R consortium worked hardly to guarantee the researchers engagement in the three cities events. On that occasion they will meet citizens also for introducing themselves and speak about their private and professional life. Researchers in Liguria are numerous and have an key scientific role in a European and Mediterranean perspective, and, thanks to their common past experiences, the network is now able to involve a high number of researchers from the

excellence centres in Liguria (IIT, CNR, UNIGE, ENEA, INGV, etc) which are engaged in different scientific fields: nanotechnology, environmental engineering, robotics, healthcare and biomedical, software, electronic hardware, technological engineering, marine engineering, environmental sustainability and ecology. This Night will present a higher number and a great variety of events: researchers will organize lab areas, "adventures" and special tours, welcoming occasions, theatre, music, performing and visual art, workshops, talks and happy hours, ice-creams breaks, puzzles, scientific dinners, cinema, awards and interviews. These activities will take place on the public transport (boats and buses), along the rivers, in gardens and parks, in museums, palaces and central squares. All the locations chosen are very close or have huge indoor spaces available for hosting all the events planned during the Night. In this way we intend to prevent from the risk of a limited participation caused by bad weather conditions as happened in the 2010 edition. Palazzo Ducale in Genoa represents the widest and fascinating indoor space of the whole region being also very close to the main streets of the old town where movida takes place especially during weekends. Here and in Palazzo Scotto Niccolari in Albenga and in the Fortress in Sarzana events will take place and go on till late at night.

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**NBR: 316571** **ACRONYM: SNO** **EC FUND: 34299**

**DG:** REA **Call: FP7-PEOPLE-2012-NIGHT** **Thema:** FP7-PEOPLE-2012-NIGHT

**Title:** Science Night Out

**Abstract:** The main idea of the "Science Night Out" proposal is to offer to the general public a night of going out and enjoying themselves with science. A common opinion that goes around when people are talking about science is that it is boring and somehow not relevant to their everyday life and personal interests. Researchers are though of as people with grey hair and white robes hiding inside their – if not secret then definitely isolated – laboratories working on subjects hardly understood by anyone else than themselves. On the other hand, people nowadays don't leave their home without their iphone and use at least once a day an internet application. Moreover, they are interested in anti-aging and find science fiction movies really cool. Isn't this an oxymoron of our times? Why iphone is great but nanotechnology seems frightening? It is because people don't connect them. People are using high tech gadgets in their every day lives ignoring their origin, are fascinated by the Milky Way pictures knowing nothing on radio astronomy and are looking forward to the latest anti-aging therapies but haven't heard of stem cells. What is missing here is the bond between the researchers and the general public. The aim of the "Science Night Out" is to bring closer researchers and people from all different ages and backgrounds, let them know about the fascinating science hidden in their everyday lives and about the research going on in Europe, get them inspired of the latest scientific achievements, introduce them to real life researchers and academics and have them enjoy themselves and having a nice time while doing so.

**NBR: 316610** **ACRONYM: CAFFEIN** **EC FUND: 3312522**

**DG:** REA **Call: FP7-PEOPLE-2012-ITN** **Thema:** FP7-PEOPLE-2012-ITN

**Title:** Cancer Associated Fibroblasts (CAF) Function in Tumor Expansion and Invasion

**Abstract:** Aim of the CAFFEIN network is to provide 10 early stage researchers (ESRs) and 2 exprerienced researchers (ERs) with excellent training in an industry relevant area of cancer research, complementary skills required for pharmaceutical industry, and knowledge in setting up biomedical start-up companies. To this end, the network comprises two full industrial partners: the established pharmaceutical company Medimmune, a global leader in immunopharmaceuticals, and the small biotech company Gimmune, which used breakthrough results in nanotechnology to establish a new enterprise. The research focus of CAFFEIN, which stands for Cancer Associated Fibroblasts (CAF) Function in Tumor Expansion and Invasion, is to understand the mechanisms, how fibroblastoid cells support tumor progression and metastasis formation. CAF biology is therefore rather complex, but the research groups of the CAFFEIN network cover many different aspects of it, thus having a critical mass to provide relevant training in this area. Training in complementary skills important for work in the pharmaceutical industry is provided by the industrial partner MedImmune, where communication with management, industrial project planning, IPR, etc. will be taught. Entrepreneurial skills, business plans, funding by venture capitalists, and patentability of research findings are highlights of the training provided by the industrial partner Gimmune. All this training is transmitted to the ESRs/ERs by networkwide events, secondments and tight research collaboration. Taken together, the CAFFEIN research training network combines the acquisition of excellent scientific knowledge in an area highly attractive for pharmaceutical industry with special education in relevant complementary skills that increase employment chances of the trained researchers in industry and that encourage them to translate their scientific results into products, thus improving health and economic welfare of European citizens.

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**NBR: 316633** **ACRONYM: POCAONTAS** **EC FUND: 3421494**

**DG:** REA **Call: FP7-PEOPLE-2012-ITN** **Thema:** FP7-PEOPLE-2012-ITN

**Title:** Polymer - Carbon Nanotubes Active Systems for Photovoltaics

**Abstract:** Organic solar cells (OSC) feature several advantages over “classical” silicon solar cells: low cost, energy effective production, low weight and semi-transparency. This makes them apt for novel applications like, building-integrated photovoltaics (BIPV) with high

market potential. However, both the efficiency and the long-term stability must be enhanced for OSCs to become profitable. POCAONTAS will develop highly efficient and stable OSCs based on tailored blends of polymers (P) with single wall carbon nanotubes (SWNT), that are ideally suited for OSCs due to their inherent stability, high carrier mobility and the tunability of optical gaps. Up to now, no breakthrough in SWNT based OSC has been achieved due to challenges with the control of SWNT-chirality, -aggregation, orbital energy mismatch and nanoscale sample morphology. Our consortium will address these issues: We will synthesize functional polymers that (i) allow for a tailored selection of SWNT chiralities, and (ii) match the SWNT energy levels to polymers for maximization of efficiency. The introduction of SWNT-P exchange protocols enables us to optimize (i) and (ii) with different polymers, avoiding compromises in performance. We will obtain optimized donor-acceptor blends, in which the SWNTs are light antenna and charge transporter. We unify leading European groups in time- (down to 10 fs) and spatially (down to 10 nm) resolved spectroscopies providing unique insights into SWNT-P interactions at the molecular level. Experts in multi-scale quantum chemical modeling will develop greater predictive power of charge transport. FLEXINK, a startup in optoelectronics materials, will provide tailored polymers. KONARKA, world leader in commercial OSCs, will build and test solar cells using our blends. Both full partners can directly exploit the project's outcome to strengthen their market position. Three associated industrial partners provide industry internships for each ESR maximizing their career perspectives.

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**NBR: 316656** **ACRONYM: SMARTNET** **EC FUND: 4129500**

**DG:** REA **Call: FP7-PEOPLE-2012-ITN** **Thema:** FP7-PEOPLE-2012-ITN

**Title:** Soft Materials Advanced Research Training Network

**Abstract:** SMARTNET ("Soft materials advanced training network") is an ITN at the interface of chemistry, physics, and biology, and deals with the science and technology of molecular soft materials. Soft matter (e.g. gels, emulsions, membranes) is of great societal and economic impact in fields such as food industry, cosmetics, oil extraction and increasingly in high value areas such as biomedicine and nanotechnology. Soft matter is formed when fluids are mixed with molecular additives, giving rise to molecular level structuring. Polymers and inorganic materials have been widely used in this context, but are unlikely to meet future performance requirements for high-tech applications. SMARTNET is focused on conceptually novel approaches towards the next generation of soft matter, based on self-assembling small molecules as promising alternatives to existing systems. The design of molecular components and control of self-assembly processes allows for organization across length scales leading to emergent properties and functions, and will impact on 21st century health care, biomedicine and energy-related technologies. SMARTNET provides a unique multidisciplinary training opportunity and a step change in understanding and exploitation of these systems. A

competitive advantage will be achieved by close integration of world-class expertise in molecular design, self-assembly and nanofabrication, photo-chemistry and -physics, multiscale modeling, state-of-the-art scattering and spectroscopy, with application areas such as biomedical, opto-electronic and catalytic materials. SMARTNET consolidates, through international and cross-disciplinary coordination and integration of 9 teams, leading EU research efforts in the area of supramolecular soft matter and offers unique opportunities to the highest level of training-through-research projects.

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**NBR: 316730** **ACRONYM: NANOGENE** **EC FUND: 387600**

**DG:** REA **Call: FP7-PEOPLE-2012-IRSES** **Thema:** FP7-PEOPLE-2012-IRSES

**Title:** EU-Belarus-Russia Network in Nanomaterials-Driven Anti-Cancer Gene Therapy

**Abstract:** Dendrimers are a new class of nanomaterials. They are monodisperse, stable, and are characterized by relatively low viscosity at high molecular mass and numerous end groups that can be ionized, which means that they can efficiently bind a large amount of genetic material and deliver it to ill organs and tissues (gene therapy). The partners of project from EU countries organized European research network in the field of dendrimers. They collaborate in the frames of EU Framework 7 Programme supported grants and initiatives: COST, MNT ERA NET 2007, ERA NET EuroNanoMed 2010. Belarus and Russia partners started to collaborate in the field of multifunctional dendrimer/carbon nanotubes as gene carriers on the basis of bilateral collaboration grant. Present project is devoted to combining of these two independent networks in one EU-Belarus-Russia platform in the field of nanomaterials for biomedical applications. The main objective of NANOGENE project is to provide the tight collaboration of five institutions from European Union, Russia and Belarus in the field of nanomaterials-driven delivery of anti-cancer siRNA into cancer cells. The aims to be achieved are: I: Encouragement and promotion of the international collaboration (trainings, promoting and facilitating the international collaboration relevant to FP8); II: International networking and strengthening of the research collaboration (workshops, strengthening the research management and scientific links existing among participating university/academia partners and distribution of best practice in FP8 project administration); III: scientific results realized in the number of papers in peer-reviewed journals and presentation of joint results at conferences. Such international co-operation is important for building linkages between EU countries and Belarus and Russia for creating better relations between institutions which results in more united Europe and for future joint FP8 proposals.

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**NBR: 316751** **ACRONYM: NANOEMBRACE** **EC FUND: 3477799**

**DG:** REA **Call: FP7-PEOPLE-2012-ITN** **Thema:** FP7-PEOPLE-2012-ITN

**Title:** Embracing One Dimensional Semiconductor Nanostructures

**Abstract:** One dimensional nanostructures (1DNS) produced from various elemental (Si and Ge) and compound (III-V and II-VI) semiconductors are receiving increasing worldwide attention due to their unique properties and potential for a wide range of applications. They are the building blocks for single photon emitters, third generation solar cells and the monolithic integration of optoelectronic devices. 1DNS can be used to fabricate the smallest light emitting devices and lasers. Despite recent progress, many fundamental and applied challenges still prevent transfer of 1DNS from laboratories to large scale industrial use. The proposed NanoEmbrace assembles eight leading industry partners and ten internationally renowned institutions in materials science, engineering, chemistry, condensed matter physics and nanoscale device fabrication. The original vision of NanoEmbrace is to gain superior control and understanding of 1DNS and to transfer 1DNS from laboratory to industry. It is probably the first organised attempt to put together all the competences and capabilities, experimental and theoretical, necessary for the comprehension of the mechanisms that govern the growth of 1DNS that cannot all be described by existing models. We also aim to provide the highest quality multidisciplinary and cross-sectoral training to early career researchers (ESRs) in nanoscience to create the next generation of research and industry leaders. The ESRs joining NanoEmbrace will have a unique opportunity to enjoy close personal contact with internationally renowned experts and to put together an unprecedented, complex but unified overall understanding of the growth of 1DNS and to develop the process required to produce practical commercial devices. To deliver the highest quality of training to young talented researchers, NanoEmbrace has identified the key research themes: controlled synthesis, theoretical modelling, characterisation of 1DNS and the integration of 1DNS into device fabrication.

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**NBR: 316866** **ACRONYM: SOMATAI** **EC FUND: 3562776**

**DG:** REA **Call: FP7-PEOPLE-2012-ITN** **Thema:** FP7-PEOPLE-2012-ITN

**Title:** Soft Matter at Aqueous Interfaces

**Abstract:** Soft nanotechnology is generally considered as a field that will have a major impact on technological developments in near future. However, the fundamental understanding of the wealth of new structures lacks far behind, despite supporting activity from material science. Such an understanding is indispensable for sustainable growth of this important research domain and its applications. A physics-oriented interdisciplinary education is urgently needed to guide young researchers to the point where they can tackle the relevant fundamental questions. SOMATAI is set up to provide just such training by combining two distinct scientific fields: Soft matter science is a well established

interdisciplinary field for the bulk investigation of polymers, colloids, and liquid crystals with response amplitude and time to external stimuli as a function of soft matter structure being of special interest. The second highly relevant field is interface science, since nano-structured materials contain a huge area of internal interfaces which have an essential impact on material properties. The application of the soft matter approach to interfaces promises new and deeper understanding of interfacial phenomena. Interfaces of a water phase to a solid, liquid or gaseous second phase are of special interest and a focal point of SOMATAI. Such interfaces are highly relevant to products from European industry (food, cosmetics, paints) and processes (washing, coating, water purification). They have an outstanding importance from a scientific point of view due to specific interactions at such interfaces. This carefully planned teaching and research programme in a network of 10 leading academic partners, 1 large scale companies, 2 SMEs, and 4 top-level associated partners from Germany, Taiwan and the USA will ensure that young researchers are given an excellent training in a pioneering research domain of high scientific and technological relevance, where Europe can take a leading position.

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**NBR: 316897** **ACRONYM: PROPAGATE** **EC FUND: 693388**

**DG:** REA **Call: FP7-PEOPLE-2012-ITN** **Thema:** FP7-PEOPLE-2012-ITN

**Title:** New Propagation Techniques for the simulation of dynamical processes in extended systems

**Abstract:** A leading European scientific software company (SCM), a research group of a private university (JacobsUni) and an associated research group with long-term history in collaborating with the industry partner (VU Amsterdam), want to collaborate in the development of advanced methods for first principles atomistic computer simulations and their application on environmentally important topics of nanotechnology and biophysics. Three ESR will develop methods allowing efficient first-principles molecular dynamics studies of the ground state, of thermally excited as well as of photo-excited states, and extended simulations using hybrid methods combining quantum mechanics with classical mechanics. The methods will be used for two applications in the fields of nanotechnology and biophysics, namely to study the high-temperature formation, solubility of mixed metal oxide heteroparticles that are interesting materials for the photoelectrolytic water splitting, the dynamics of the photo-excited states in these systems, and to investigate the signal transduction in light-sensitive proteins. The fellows will be trained in technical, industry, academic and transferable skills, all of them necessary for this intersectoral and supra-disciplinary project. PROPAGATE will be supported by an ongoing MC-IAPP scheme between JacobsUni and SCM and by a starting MC-IRSES project coordinated by JacobsUni.

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**NBR: 317079** **ACRONYM: NANOMEM** **EC FUND: 2814628**

**DG:** REA **Call: FP7-PEOPLE-2012-ITN** **Thema:** FP7-PEOPLE-2012-ITN

**Title:** Membrane Protein Nanocrystallography

**Abstract:** Modern structural biology builds upon synergies between lab-bench scale science on the one hand and large scale research infrastructure on the other. NanoMem recognises the transformative opportunities that are created by current X-ray source and detector developments to impact strongly on membrane protein structure, a challenging sub-field of structural biology. We will exploit synchrotron based micro-focus X-ray beams to address challenging diffraction studies from small membrane protein crystals; and embrace the revolutionary possibilities created by X-ray Free Electron Lasers to deliver an entirely new regime of high-resolution serial femtosecond crystallography of membrane proteins. These developments will place heavy demands on motivated and highly-trained talent. The time is ripe for bringing young scientists into the loop. Nanomem will train the nucleus of a new community spread across Europe that widens the access and use of non-conventional methods to capture membrane protein structures at high resolution. Our interdisciplinary and intersectorial research training work programme incorporates membrane protein production, purification and crystallisation, micro and nano-crystal manipulation, micro-focus diffraction at synchrotron sources, nano-focus diffraction at X-ray free electron lasers, serial femtosecond crystallography, software development, drug design, and commercialisation of the most helpful innovations. On-site scientific training of nine ESRs and one ER with seamless industrial participation will be complemented with training in areas such as intellectual property, communication skills and scientific mentoring. The current major European effort in the construction of new brilliant X-ray sources has to be matched by an investment in nurturing the birth of a scientific community for its exploitation, pushing the limits of our understanding of membrane protein structural biology.

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**NBR: 317110** **ACRONYM: ESCODNA** **EC FUND: 4070204**

**DG:** REA **Call: FP7-PEOPLE-2012-ITN** **Thema:** FP7-PEOPLE-2012-ITN

**Title:** European School of DNA Nanotechnology

**Abstract:** DNA Nanotechnology is an emerging interdisciplinary area that will underpin the development of future nanoscience-based technologies for areas such as medicine, diagnostic tools, optics and electronics. DNA nanotechnology is based on the unique self-assembly properties of DNA which allow the rational design and synthesis of complex nanoscale structures with predictable form and function. Many other materials

can be integrated in such DNA structures to create highly functional nanodevices. The Marie Curie ITN EScoDNA will establish a sustainable European School of DNA Nanotechnology. By providing high quality training to young scientists, EScoDNA will improve their career prospects in both public and private sectors; it will also strengthen the competitive position of European research and industry in this promising strategic field. A network of leading European researchers, two SMEs and a major commercial research institute will work together to foster the development of a new generation of scientists with the skills required to meet future challenges in DNA nanotechnology, from fundamental science to novel applications. The training program will involve collaborative research projects, including international secondments and exchange of data through a web-based Lab-Wiki Journal, and through summer schools and workshops. The industrial partners will be integrated in the training programme, and the two SMEs will coordinate training related to the commercial exploitation of new technologies, management and entrepreneurial skills. They will also take a lead in managing the protection and commercialization of new technologies arising from research with the ITN. The programme is designed to create a pool of highly qualified researchers prepared for a wide range of careers in bionanotechnology and nanofabrication and, especially, capable of contributing to the development of a strong European centre for the scientific and commercial development of DNA nanotechnology.

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**NBR: 317116** **ACRONYM: NANOMICROWAVE** **EC FUND: 4063807**

**DG:** REA **Call: FP7-PEOPLE-2012-ITN** **Thema:** FP7-PEOPLE-2012-ITN

**Title:** Microwave Nanotechnology for Semiconductor and Life Sciences

**Abstract:** Current applications of microwave technologies in communications, remote sensing and in industry are based on the properties of the interaction of microwaves with matter at supra-wave length scales (above centimetres). The developments performed in Nanotechnology in recent years makes now conceivable to explore the interaction of microwaves with matter at much smaller scales, from micrometres to nanometres. At these sub-wave length scales it is expected that fascinating new physical phenomena may appear, which will give rise to new applications of microwave technologies with high added value, in particular, in field such as nano-electronics, nano-spintronics, nanobiology and nano-medicine. Being an emerging technology there is a need for training early stage researchers in this field of research so that enough critical mass can be achieved. The main objective of this network is to train a whole generation of researchers in the field of nanoscale microwave technologies and related emerging applications in the fields of semiconductor industry and life sciences. The researchers of the network will acquire a state of the art multidisciplinary scientific training in this field of research, covering from basic science to industrial applications, thus enabling them to generate new knowledge with high impact. In addition, they will receive a practical

training on transferable skills in order to increase their employability perspectives and to qualify them to access to responsibility job positions in the private and public sector. The final aim of the network is to help Europe to position and consolidate in a leading position in the field of nanoscale microwave technologies and related applications.

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**NBR: 317232** **ACRONYM: FQT** **EC FUND: 3816691**

**DG:** REA **Call: FP7-PEOPLE-2012-ITN** **Thema:** FP7-PEOPLE-2012-ITN

**Title:** Frontiers in Quantum Technology

**Abstract:** Mission Statement: To deliver an internationally competitive student cohort who will be equipped to be the research and industry leaders of the future through interdisciplinary training at the frontiers of Quantum Technology. The ability to engineer materials at the atomic level has led to the enormously active field of nanotechnology: the analysis, design and fabrication of devices that operate at the leading-edge of optical and electronic technology. This technology has inevitably revealed the true quantum nature of the microscopic world, where particles and waves co-exist and interact in novel exciting ways. The study of quantum information and quantum technology has now been around for some time, and this is the ideal opportunity for the fundamental science to work with industrial researchers to make advancements which the market wants, rather than those which serve only the scientists' curiosities. Along this line, we have identified two strands of research themes, namely, the generation of extreme light sources and the study of light-matter interactions, with a view to the development of quantum technology. Imperial College has a large team of researchers (17 members of academic staff and 50 postdoctoral fellows: research grants over £30m) working at the leading edge of quantum sciences encompassing surface plasmonics, cold atoms, attosecond lasers and quantum theory. Coupled with newly refurbished postgraduate lecture facilities, a brand new state-of-the-art workshop, and new offices for the quantum theory group this makes Imperial ideal for student training. The associated partners include top academic institutes, government labs and private companies which will be actively involved in student recruitment, research and training. Imperial has been known for attracting world's best students and with the current IDP we will be able to train those students to become leading scientists with the creative ideas to answer the beneficiaries' needs.

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**NBR: 317348** **ACRONYM: ACRITAS** **EC FUND: 3882671**

**DG:** REA **Call: FP7-PEOPLE-2012-ITN** **Thema:** FP7-PEOPLE-2012-ITN

**Title:** Actuation and characterisation at the single bond limit

**Abstract:** Scanning probe microscopy(SPM) has now evolved to the point where not only is imaging and manipulation with single atom resolution achievable but the state of the art in the field involves sub-molecular and sub-atomic resolution: individual chemical bonds can be resolved, their properties measured, and their spatial symmetry exploited. SPM is, however, increasingly a victim of its own success. The wide availability of commercial instruments means that the technique is now very commonly seen as a routine imaging and characterisation tool. This unfortunately engenders a mindset amongst young researchers where they see an SPM as a "black box" and typically have a superficial understanding of the operating principles, theoretical principles, and current (or ultimate) limits of the technique. In turn, this "black box" mentality has severe implications for the health and competitiveness of the SPM - and, by extension nanoscience and nanotechnology - sectors in the ERA which rely fundamentally on creative innovation. ACRITAS directly counters this decline in the skills base and creativity of young researchers by providing an exciting and challenging environment for SPM training, spanning the public and private sectors and redefining the state of the art. A defining aspect of the network is its integration of scanning probe groups whose research is carried out under what might be termed `extreme' conditions (ultrahigh vacuum, cryogenic temperatures) with teams of scientists who focus on interactions and control in biologically relevant environments. Although both communities use the same types of experimental techniques, there has traditionally been rather little communication between the two, largely because of different disciplinary biases. ACRITAS will act as a new and important bridge between the physical- and life sciences in advanced SPM and will thus be unique in the training it provides in a field which underpins a vast amount of 21st century science

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**NBR: 317354** **ACRONYM: NEXTDX** **EC FUND: 3608000**

**DG:** CNECT **Call: FP7-ICT-2011-8** **Thema:** ICT-2011.3.2

**Title:** Next-generation integrated MNBS-platform for instant diagnostics with single-molecule resolution

**Abstract:** A spearhead function that lies within the promise of MNBS technologies is the rapid and sensitive detection of biomarker molecules in raw biological samples. However, it has been very difficult to realize the promise due to two key challenges: the signal-over-background challenge, i.e. many biomarkers have very low concentrations and real-life biological samples generate very high background signals, and the integration challenge, i.e. it is very difficult to conceive a system that has a very high performance and is still fully integrated, miniaturized, and cost-effective. NextDx will address these challenges by investigating an integrated system for protein biomarker detection with single molecule resolution. The system is based on magnetic nanoparticles that are controlled

by electromagnetic fields and detected with nanometer precision in an integrated optical chip with bio-engineered surface. The system will allow a sharp biophysical discrimination between biomarker-induced and non-biomarker-induced nanoparticle binding signals, so as to approach the fundamental limit of counting statistics in real biological samples. This is a unique, novel, and timely approach. At the end of NextDx, we will demonstrate an integrated MNBS platform technology for extremely sensitive protein detection, within a few minutes, directly in blood plasma. The technology will be suitable for multiple biomarker testing outside the hospital, to improve for example the lives of chronically ill patients. NextDx is a unique international consortium with best-in-class partners contributing complementary physical and biomolecular engineering expertise, supported by an advisory board with all relevant stakeholders (clinicians, patient organisation, insurance company, regulatory agency). Together, all are focused on generating new insights in MNBS integration and on effective industrial-academic collaboration on the European scale towards next-generation integrated diagnostics.

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**NBR: 317451** **ACRONYM: MOWSES** **EC FUND: 3703140**

**DG:** REA **Call: FP7-PEOPLE-2012-ITN** **Thema:** FP7-PEOPLE-2012-ITN

**Title:** Nanoelectronics based on two-dimensional dichalcogenides

**Abstract:** Semiconductor industry rapidly approaches the performance limits of silicon-based CMOS technology. This proposal aims to pave the way to electronic circuits based on two-dimensional transition metal dichalcogenides (TMDs), newly emerging semiconducting analogues of graphene. TMDs can be rapidly exfoliated in the liquid phase into single layers starting from powders and provide solutions of 2D materials that can be coated over large areas. The recently achieved transistors based on single-layer MoS2 indicate a mobility comparable or even higher than silicon thin films or graphene nanoribbons, but with much lower leakage currents. In a joint effort of wet and gas phase chemistry and deposition techniques, nanoanalytics, electronic and optical spectroscopy, electronic device fabrication and characterisation, and theoretical modeling we aim to control the production and deposition of TMD nanolayers and nanoribbons, understand and control the interplay between morphology, defects and electrical properties, understand electrical transport through semiconducting nanolayers, and fabricate nanodevices. By combining the ease of processing commonly associated with organic electronics with superior electrical properties, we will demonstrate a new type of low-power, low-cost field effect transistor based on a single TMD layer and/or nanoribbon. The proposed outcomes of immediate interest for the three full partners from industry are (i) process flows and practices that enable fabrication of nanoscale transistor arrays for application in flexible electronics via spraying and/or ink-jet printing, (ii) software packages for modeling the electronic behavior of TMD nanolayers, and (iii) a prototype reactor for their large-scale growth and deposition. The training and dissemination activities will be complemented by an

associated partner who will produce educational videos together with the young researchers of the consortium.

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**NBR: 317497** **ACRONYM: EDISON-GA** **EC FUND: 1467957**

**DG:** REA **Call: FP7-PEOPLE-2012-ITN** **Thema:** FP7-PEOPLE-2012-ITN

**Title:** European Doctorate in Image Sensors with Optical Nanotechnology at Glasgow and Awaiba

**Abstract:** Digital cameras designed with CMOS image sensors are one of the fastest growing sectors of the consumer electronics market. With increasing number of pixels and improving image quality, they have found applications in a range of systems from mobile handsets to space observatories. Despite this growth, they still suffer from limited dynamic range and poor colour discrimination abilities. Furthermore, increasing number of pixels have led to increasing power dissipation in these sensors. This project would train early stage researchers in the design of image sensors utilising optical nanotechnology, in particular plasmonic filters. These filters would help improve the colour response of the next generation of sensors. More importantly, the project would also develop a large format high intensity imager, which would be useful for improved radiotherapy in the treatment of cancer. The network would provide training and research opportunity to ESRs in an academic, industrial as well as clinical environment.

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**NBR: 317554** **ACRONYM: MSNANO** **EC FUND: 269200**

**DG:** REA **Call: FP7-PEOPLE-2012-IRSES** **Thema:** FP7-PEOPLE-2012-IRSES

**Title:** A Multiple-Scattering Computing Platform For (Nano) Materials

**Abstract:** Our society relies more and more on the finding of new materials for the advancement of technology. Prior to being used for applications and in order to be tailored to specific properties, materials have to be carefully characterized and the connection between their properties and underlying electronic, magnetic and crystallographic structure must be clearly understood. This is where electron and photon spectroscopies come into play. Thanks to their unique specificities and the use of synchrotron radiation, they have the capability to access all the requested information at the nanoscopic and the atomic levels with enhanced accuracy. However, this accuracy can only be achieved by comparison to a calculation based on a suitable theoretical model, as no reliable inversion of the experimental data can directly achieve such a necessary accuracy. Moreover, recent breakthroughs in their theoretical modelling make us hopeful that in the coming years calculations of the experimental signal will reach a predictive level,

thereby offering the possibility to by-pass some expensive experiments. Multiple scattering is a major issue in the devising of an accurate and flexible framework that can deal in the same way with periodic and non-periodic materials, with nanostructures and over a very wide range of energies. The purpose of the present project is to offer the scientific community a unique computing platform able to deal with the characterization of all sorts of materials using various spectroscopies. To this purpose, we will gather the expertise of nine participants, all specialized in the multiple scattering description of spectroscopies. The sharing of complementary expertise will allow us to propose to the user (experimentalists and theoreticians) a coherent set of computer programs that will have the generality and the multi-technique capability lacking in the actual individual codes.

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**NBR: 317662** **ACRONYM: NASCENCE** **EC FUND: 2900000**

**DG:** CNECT **Call: FP7-ICT-2011-8** **Thema:** ICT-2011.9.6

**Title:** NAnoSCale Engineering for Novel Computation using Evolution (NASCENCE)

**Abstract:** The aim of this project is to model, understand and exploit the behaviour of evolving nanosystems (e.g. networks of nanoparticles, carbon nanotubes or films of graphene) with the long term goal to build information processing devices exploiting these architectures without reproducing individual components. With an interface to a conventional digital computer we will use computer controlled manipulation of physical systems to evolve them towards doing useful computation. During the project our target is to lay the technological and theoretical foundations for this new kind of information processing technology, inspired by the success of natural evolution and the advancement of nanotechnology, and the expectation that we soon reach the limits of miniaturisation in digital circuitry (Moore's Law). The mathematical modelling of the configuration of networks of nanoscale particles combined with the embodied realisation of such systems through computer controlled stochastic search can strengthen the theoretical foundations of the field while keeping a strong focus on their potential application in future devices. Members of the consortium have already demonstrated proof of principle by the evolution of liquid crystal computational processors for simple tasks, but these earlier studies have only scraped the surface of what such systems may be capable of achieving. With this project we want to develop alternative approaches for situations or problems that are challenging or impossible to solve with conventional methods and models of computation. Achieving our objectives fully would provide not only a major disruptive technology for the electronics industry but probably the foundations of the next industrial revolution. Overall, we consider that this is to be a highly adventurous, high risk project with an enormous potential impact on society and the quality of life in general, including medicine, everyday household items, energy-saving policies, security, and communication.

**NBR: 317692** **ACRONYM: BINOS** **EC FUND: 75000**

**DG:** REA **Call: FP7-PEOPLE-2012-CIG** **Thema:** FP7-PEOPLE-2012-CIG

**Title:** Bistable Nano-Objects on Surfaces

**Abstract:** Coordination networks are molecular systems that show various physical properties (magnetic, electrical, optical, etc.). Some networks have the particularity to have bistable states, which are interesting towards the development of memories, switches or sensors. The study of the evolution of their properties at the nanometer scale let us foresee the development of miniaturized systems that can be included in more complex devices. The objective of this project is to develop synthesis tools of bistable coordination nanosystems on inorganic surfaces. We plan to use simple techniques of surface chemistry that do not require expensive facilities. In a second time, we will characterize the physical properties of these systems and we will determine the specific effects of the size reduction to the nanometer scale. We will use very sensitive techniques, adapted to systems with few materials, for which the weakness of the signals is often a critical element. Finally, we will use these techniques to address the systems in a controlled manner. Indeed, in order to develop memory devices, it is necessary to write and read the information independently. We also plan to perform measurements in environmental conditions with the purpose of elaborating sensors.

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**NBR: 317744** **ACRONYM: FAMOS** **EC FUND: 10099999**

**DG:** CNECT **Call: FP7-ICT-2011-8** **Thema:** ICT-2011.3.5

**Title:** Functional anatomical molecular optical screening

**Abstract:** Biophotonics offers low-cost, non-invasive, accurate, rapid alternatives to conventional diagnostic methods and has the potential to address medical needs with early detection and to reduce the cost of healthcare. FAMOS will develop a new generation of light sources with step-changes in performance beyond the state-of-the-art to radically transform biophotonic technologies for point-of-care diagnosis and functional imaging. This will enable optical diagnostics with superior sensi-tivity, specificity, reliability and clinical utility at reduced cost, heralding an imaging renaissance in Europe. FAMOS addresses optical imaging from molecular over (sub)cellular to individual organs, with no gap in the arsenal of diagnostic tools for medical end-users. The world-class multidisciplinary FA-MOS team of 7 leading academic institutions and 10 top SMEs has unique complementary knowledge of optical coherence tomography, adaptive optics, photoacoustic tomography, coherent anti-stokes Raman scattering, multiphoton

tomography as well as swept-source, diode-pumped ultrafast and tuneable nanosecond pulse lasers. Combinations of some techniques will offer multi-modal solutions to diagnostic needs that will exploit and enhance the benefits of each modality. FAMOS technologies have wide applicability, but our specific focus is on diagnosis in ophthalmol-ogy and oncology. Partnerships with leading innovative clinical users will enable preclinical evalua-tion. The objectives of FAMOS are: • Develop new light sources with a step-change in performance (2-3 times more compact and up to 3-4 times cheaper diode pumped Ti:sapphire, 4-10 times faster swept sources and tuneable nanosecond pulse sources) • Integrate these with optical imaging for a step-change in diagnosis (2-5 times better resolution cellular retinal imaging with more than 10 times larger field of view, up to 10 times enhanced penetration single source subcellular morphologic imaging, increased selectivity of intrinsic mo-lecular sensing as well as several frames per second deep tissue functional tomography • Perform preclinical studies to demonstrate novel or improved ophthalmic and skin cancer diag-nosis establishing novel biomarkers (melanocyte shape, NADPH, melanin concentration, Hb/HbO2 as well as lipid, water and DNA/RNA concentration) • Enable exceptional commercial opportunities for SMEs • Provide state-of-the-art academic training

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**NBR: 317884** **ACRONYM: MIRIFISENS** **EC FUND: 8600000**

**DG:** CNECT **Call: FP7-ICT-2011-8** **Thema:** ICT-2011.3.5

**Title:** Mid InfraRed Innovative lasers For Improved SENSor of hazardous substances

**Abstract:** The mid-infrared (MIR) region is emerging as the favourite wavelength band for a number of applications, including high sensitivity trace detection, chemical emission monitoring, process control, and biological sensing applications. An efficient way to get precise and reliable information is to rely on spectroscopic analysis and, among the existing technologies, Tunable Diode Laser Spectroscopy (TDLS) has been identified to be the most attractive solution due to the unique adsorption spectrum of chemicals, allowing their unambiguous detection. In the MIR region, the availability of Quantum Cascade Lasers (QCL) covering a broad portion of the spectral range (MIR, 3-12 µm), where many chemicals of interest for Safety & Security have their strongest absorption lines, has recently pushed forward the commercialisation of TDLS-based detection units. Further technology advancements are still needed in the TDLS and QCL domains, the crucial bottlenecks being the range of tuneability, the footprint, power consumption & wallplug efficiency. Besides high cost and poor versatility, these limitations set a barrier for the realisation of powerful versatile detection units. To address these issues, MIRIFISENS will bring major technological advancements in the field of miniaturisation, process development, heterogeneous integration and co-integration of MOEMS functionalities. The project will exploit state-of-the-art micro and nano-fabrication techniques. The major technologic achievements proposed will address the issues of sensitivity & selectivity, multi-gas capabilities, compactness, efficiency and cost

effectiveness as specified by a number of selected Safety & Security applications. These achievements will be tested and validated for these applications. MIRIFISENS will deliver a new class of sensors with superior tuneability, better portability and extended detection capabilities, changing radically the current landscape of MIR chemical sensing spectroscopy.

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**NBR: 317950** **ACRONYM: MOSAIC** **EC FUND: 3499178**

**DG:** CNECT **Call: FP7-ICT-2011-8** **Thema:** ICT-2011.3.1

**Title:** MicrOwave Spintronics as an AlternatIve Path to Components and Systems for Telecommunications, Storage and Security Applications

**Abstract:** Innovative components and systems based on nano-engineered semiconductor, magnetic or insulating materials will be the driving force for the micro- and nano-electronics industry of the 21st century. For telecommunications systems, but also for data storage and Automation, Control and Security applications, alternative More than MOORE paths to systems are provided by nano-scale microwave spintronics components due to (i) their unique spin polarized transport properties that appear only at nanoscale dimensions (

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**NBR: 318053** **ACRONYM: SMARTCANCERSENS** **EC FUND: 584800**

**DG:** REA **Call: FP7-PEOPLE-2012-IRSES** **Thema:** FP7-PEOPLE-2012-IRSES

**Title:** Micro/nanosensors for early cancer warning system - diagnostic and prognostic information

**Abstract:** Oncologists still rely heavily on biological characterisation of tumours and a limited number of biomarkers which have demonstrated clinical utility. Routine cancer diagnostic tools may not be always sensitive enough and may only detect proteins at levels corresponding to an advanced stage of the disease. Recently, new genomic and proteomic molecular tools (molecular signatures) are being employed which include genetic and epigenetic signatures, changes in gene expression, protein profiles and post-translational modification of proteins. Such advanced diagnostic tools are not always readily adapted to clinical cancer screening due to their complexity, costs and the requirement for highly-qualified operators. Novel bioanalytical methodologies for detection of specific biomarkers/ biomolecules, based on nanostructured electronic sensors (rapid, sensitive devices capable of miniaturisation and deployment on site or in small clinics), fulfill the necessary requirements and have the potential to compliment time- and labour consuming clinical analysers used in medical laboratories currently. The

primary objective of this proposal, therefore, is to gather together an international and interdisciplinary consortium of ten research teams from EU Member States, Third (including ENP) countries with EU agreements on S&T, in order to share and jointly exploit knowledge and expertise in the development of micro/nanosensors as tools in early cancer diagnosis. A key scientific target is the realisation of intelligent electronic devices which respond to biomolecules such as formaldehyde, amines, metal ions, saccharides, activities of amine oxidases, arginase and glutathione-S-transferase. This will entail design, development and characterisation of nano-scale transducers suitable for testing in clinical samples.

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**NBR: 318088** **ACRONYM: ML²** **EC FUND: 7690995**

**DG:** CNECT **Call: FP7-ICT-2011-8** **Thema:** ICT-2011.3.2

**Title:** Design platform for economic production of multilayer Micro-Nano Bio Systems

**Abstract:** Microfluidics and lab-on-chip is an enabling technology with great growth potential. The life science industry has come to realise the trends and potential of miniaturisation which already have effected the information and communication industry in the last decades. Combinations of microfluidics, microelectronics and microoptics provide striking opportunities for advancing biomedical research and creating new markets for the medical sciences industry. In terms of economical and ecologically worthwhile processes, complex Micro-Nano Bio Systems (MNBS) have greatest potential to enhance processes for cell-based assays, chemical analytics and medical diagnostics. However, there are three main challenges for such (MNBS) market to overcome which hamper growth of the market: First, a lack of economical micro-fabrication methods hamper the implementation of lab-on-chip solutions in an industrial scale. Second, inefficient interfaces between laboratory equipment and mircofluidic devices cause a lack of interoperability. Third, there is no integrated manufacturing platform which provides flexible and cheap design and re-design opportunities. ML² will overcome these three main challenges by developing a cost efficient production system for new generation MNBS, combining microfluidics, optics and microelectronics. The devices will base on a multi layer concept. The overall function of the smart device will be split in several subfunctions, which can be of fluidic, optical or electronic nature. Multiple foils will transfer the functionality into technical solutions. Economic roll-to-roll processes will be developed for the production of micro fluidic and optic functional layers. ML² will provide a design and manufacturing platform for the production of sophisticated devices which combine microfluidics, optics and microelectronics. ML² devices will compact devices with increased performance at lower prices compared to existing MNBS.

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**NBR: 318117** **ACRONYM: NANOTHERM** **EC FUND: 6070000**

**DG:** CNECT **Call: FP7-ICT-2011-8** **Thema:** ICT-2011.3.1

**Title:** Innovative Nano and Micro Technologies for Advanced Thermo and Mechanical Interfaces

**Abstract:** Future electronic power devices and packages will need to demonstrate more performance and functionality at reduced cost, size, weight, energy consumption and thermal budget. Further, increasing reliability demands have also to be met by industry to be competitive in this growing multi-billion Euro market of heterogeneously integrated systems.To respond to these challenges, new innovative nano- and micro-technologies and materials, both of which are key enablers for advanced thermal and mechanical interfaces, have to be developed and compatibly integrated to obtain higher electrical, thermal and reliability performance under harsh environmental conditions.Nanotherm's objective is to take up these challenges in design, technology and test:Novel approaches to thermal technologies with superior electrical, thermal and thermo-mechanical properties will be developed in the project and demonstrated on automotive, avionics, solid-state lighting and industrial applications. Parallel routes will be followed addressing nano-sinter-adhesive bonding, phonon-coupled VACNT joining, nano-functionalised nano-filled adhesive die attach and graphene-enhanced surfaces. The main principle common to all technologies is the exploitation of nano-effects to obtain outstanding interconnect properties by especially developed processes.In parallel, a multi-scale and multi-domain modelling framework will furnish guidelines for materials design by various approaches from ab-inito up to continuum modelling and verified by corresponding experimental techniques.The consortium, composed of 18 partners from industry, SME and academia out of 8 European countries, embodies the necessary excellence and interdisciplinarity to address these tasks successfully. We are convinced that Nanotherm's results will enable the next generation of heterogeneously integrated power packages, cut down thermal interface resistance at least by 50% and impact also on other power system-in-package configurations.

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**NBR: 318247** **ACRONYM: VECTOR** **EC FUND: 3100000**

**DG:** CNECT **Call: FP7-ICT-2011-8** **Thema:** ICT-2011.3.5

**Title:** Versatile Easy installable Connector incorporating new Technologies for accelerated fiber Optic network Roll outs in Europe

**Abstract:** VECTOR (Versatile Easy installable Connector incorporating new Technologies for accelerated fiber Optic network Roll outs in Europe) aims to develop and commercialize an innovative low-cost highly performing field installable connectivity system that will impact at a multi-million-euro scale the capital expenditure (CAPEX) and the operation expenditure (OPEX) of telecom fiber broadband networks and that will facilitate the

achievement of the European 2020 objectives for broadband connectivity. The VECTOR connectivity system will comprise a ferrule-less connector granting ultra-high optical performance and a fully automated installation tool allowing for field installation by a general-skill technician. Disruptive fibre-handling techniques based on heat-shrinkable materials, advanced nano-textiles, and plasma-shaping will be developed and incorporated in the installation tool to ensure reliability, whereas high-tech gels and micro-mechanical alignment systems will be included in the connector to yield superior optical performance. Finally, micro-fabrication and replication techniques will be propose to ensure ease of volume production at low price. The use of connectors instead of permanent splices will grant flexible reconfigurability of the network. Overall, VECTOR aims to outperform the state-of the-art of ferrule-based connectors by optical performance, flexibility, reliability and cost. This will ultimately break the current paradigm of ferrule-based optical connectivity requiring extensive pre-engineering and highly specialized manpower for field deployment. In order to succeed in this ambitious goal, we created a consortium comprising the full portfolio of required technical knowledge, as well as the critical mass necessary to turn our connectivity system into a commercial reality that potentially can be deployed in the optical networks of whole Europe.

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**NBR: 318287** **ACRONYM: LANDAUER** **EC FUND: 2400000**

**DG:** CNECT **Call: FP7-ICT-2011-8** **Thema:** ICT-2011.9.8

**Title:** Operating ICT basic switches below the Landauer limit

**Abstract:** The scientific objective of this project is to test the fundamental limits in energy dissipation during the operation of physical switches representing the basic elements of logic gates. We address the physical limits arising from a generic switch mechanism that is common to any digital device, with specific reference to the fundamental limit arising from the decrease of information in the computation procedure, also known as Landauer limit. The technological objective of this project is to introduce new conceptual devices that, through novel computing paradigms with radically improved efficiency, are capable of trading the minimum amount of energy dissipated with the computational precision. In order to reach such objectives in a joint effort, the LANDAUER consortium composed by world leading experts in nanoscale energy management will fabricate, test and evaluate three classes of new conceptual devices: “magnetic switching nanoparticles”, “nanomechanical switches” and “nanoelectronic stochastic logic gates” addressing applied prototypes for computing tasks in the presence of noisy operating conditions.

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**NBR: 318352** **ACRONYM: NANO RF** **EC FUND: 4345000**

**DG:** CNECT **Call: FP7-ICT-2011-8** **Thema:** ICT-2011.3.1

**Title:** CARBON BASED SMART SYSTEMS FOR WIRELESS APPLICATIONS

**Abstract:** From the strategic agendas of ENIAC,EPoSS and ITRS it is evident that wirelessapplications are gaining more and more importance that results to new requirements in terms of miniaturization and increased complexity.The limitations of Moore's Law in term of physics but also in terms of manufacturability, flexibility and multi-functionality has motivated research and development to implement new technologiesand new wireless architectures identified as Beyond CMOS and More than Moore.Carbon nanotubes are featuring very attractive intrinsic multi-physic properties. These properties coupled with CMOS compatibility offer promise for a new generation of smart miniaturised systems for wireless communications.Graphene also exhibits impressive electrical and mechanical properties.CMOS compatible microwave graphene devices, still at their infancy, hold promise for extremely low noise and high speed communications.The coordinator (TRT) is one of the major world players in civilian & professional electronics.TAS is N°1in Europe and N°3 worldwide for civil and military aerospace products. One key area for their products is T/R front-end systems for applications like radars for which long term solutions are continuously sought after.The main concept of NANO-RF is the development of CNT&graphene based advanced component technologies for the implementation of miniaturised electronic systems for 2020 and beyond wirelesscommunications and radars.The major objectives of NANO-RF are the development of: Active components from CNTs&graphene Passive components from CNTs& grapheneCapacitive RF NEMS from CNTsCNTs based vertical interconnectsCNTs & graphene based ICsThe developed components and technologies will be implemented in the following demonstratorsReflect array antennae for wake vortex and weather radars and Graphene receiver moduleThe demonstrators will exhibit the reconfigurability, systemability, integratability and manufacturability of thedevelopedtechnologies and unify advanced

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**NBR: 318372** **ACRONYM: NANODEM** **EC FUND: 3983000**

**DG:** CNECT **Call: FP7-ICT-2011-8** **Thema:** ICT-2011.3.2

**Title:** NANOphotonic DEvice for Multiple therapeutic drug monitoring

**Abstract:** Project aim is the development of a novel therapeutic drug monitoring point-of-care-testing (POCT) device for the measurement of immunosuppressants and related metabolites in transplanted patients. The new device will allow the automatic measurements of therapeutic drugs and metabolites characterized by a narrow therapeutic range and serious potential side effects. Clinical benefit will be an optimized dosage of the respective therapeutical drug. The patient will be connected to the device

by an intravenous microdialysis catheter to allow 48-h online measurements. Based on this minimally-invasive approach, the therapeutic drugs and related metabolites will be monitored at short time intervals. The need of mixing the dialysate with the chemical reagents and the necessity of incubation times for the bioassay implementation, unavoidable procedure for bioanalyte detection, implies that a continuous measurement of such analytes is impossible, but the miniaturisation down to micro- and nano-scales will lead to very short time intervals, of the order of a few minutes. Heart of the device will be a multi-parametric optical chip, which will make use of the recent developments in nanotechnology to convert the concentration changes of the analytes in detectable luminescent signals. Essential sections of the device will be also: i) the microfluidic circuit before the chip, where the dialysate is mixed with the reagents necessary for the implementation of the biological assay; ii) the optical detection system which must be characterised by high efficiency and strong compactness; iii) the compact hardware control unit and user interface that allow instrument control and data handling. The integration of all these sections within the POCT stand-alone device requires the convergence of competences ranging from chemistry and biochemistry to optics and medicine as well as the convergence of micro and nanotechnologies, such as micro/nanofluidics,microdialysis and micro/nanosensing.

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**NBR: 318408** **ACRONYM: DISCOGNOSIS** **EC FUND: 2922000**

**DG:** CNECT **Call: FP7-ICT-2011-8** **Thema:** ICT-2011.3.2

**Title:** Disc-shaped point-of-care platform for infectious disease diagnosis

**Abstract:** The project aims to develop a fully integrated, automated and user-friendly platform for infectious disease diagnosis. Malaria can be treated in just 48 hours, but delayed or false diagnosis or missing a relevant alternative cause of fever may be lethal. Therefore, other diseases with similar clinical symptoms will be investigated too. DiscoGnosis will integrate micro, nano, and bio components into a multi-functional point-of-care platform, performing simultaneously protein and genetic analysis to timely and accurately identify major pathogenic causes of fever, enabling proper treatment. A foil-based centrifugal microfluidic lab-on-a-chip cartridge, core of the platform, will integrate monolithically all necessary unit operations for raw sample treatment (blood-to-result regime), from sample collection and injection, to plasma separation, DNA extraction and purification. Low-cost production, scalable from prototype to batch fabrication (with proper quality control, calibration and standards specifications) will render the platform affordable to end users, even in developing countries; high sensitivity detection and multiplexity will rely on magnetic microparticles and quantum dot technologies, supported by dedicated optics development; rapid analysis (~30 min) will be achieved via isothermal DNA amplification protocols. The entire system will be validated in a controlled field test with standardized samples and by end-users in high-risk developing countries through partners' established contacts. Data management will be

implemented to allow rational organization in the field and to reinforce the “shield” of Europe against such diseases, as more than 30,000 malaria cases are reported annually among returning European tourists. This generic point-of-care platform can be applied to many diseases (eg, cancer, cardiovascular, Alzheimer) by only changing its bio-components. The strong SME participation indicates the high commercialization potential of the project.

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**NBR: 318458** **ACRONYM: SUPERTHEME** **EC FUND: 3300000**

**DG:** CNECT **Call: FP7-ICT-2011-8** **Thema:** ICT-2011.3.1

**Title:** Circuit Stability Under Process Variability and Electro-Thermal-Mechanical Coupling"

**Abstract:** Among the physical limitations which challenge progress in nanoelectronics for aggressively scaled More Moore, Beyond CMOS and advanced More-than-Moore applications, process variability and the interactions between and with electrical, thermal and mechanical effects are getting more and more critical. Effects from various sources of process variations, both systematic and stochastic, influence each other and lead to variations of the electrical, thermal and mechanical behavior of devices, interconnects and circuits. Correlations are of key importance because they drastically affect the percentage of products which meet the specifications. Whereas the comprehensive experimental investigation of these effects is largely impossible, modelling and simulation (TCAD) offers the unique possibility to predefine process variations and trace their effects on subsequent process steps and on devices and circuits fab-ricated, just by changing the corresponding input data. This important requirement for and capability of simulation is among others highlighted in the International Technology Roadmap for Semiconductors ITRS. A project partner has also demonstrated how correlations can be simulated. Within SUPERTHEME, the most important weaknesses which limit the use of current TCAD software to study the influence of both systematic and stochastic process variability and its interaction with electro-thermal-mechanical effects will be removed, and the study of correlations will be enabled. The project will efficiently combine the use of commercially available software and leading-edge background results of the consortium with the implementation of the key missing elements and links. It will bridge the current critical gap between variability simulation on process and device/interconnect level, and include the treatment of correlations. The capabilities of the software system will be demonstrated both on advanced analog circuits and on aggressively scaled transistors.

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**NBR: 318520** **ACRONYM: BIOSENSORS-AGRICULT** **EC FUND: 292600**

**DG:** REA **Call: FP7-PEOPLE-2012-IRSES** **Thema:** FP7-PEOPLE-2012-IRSES

**Title:** DEVELOPMENT OF NANOTECHNOLOGY BASED BIOSENSORS FOR AGRICULTURE

**Abstract:** The key objective of the "DEVELOPMENT OF NANOTECHNOLOGY BASED BIOSENSORS FOR AGRICULTURE" project is the coordinated transfer of knowledge and training activities between participating teams in the EU (Riga, Linkoping, Montpellier), in the Ukraine (Odessa and Kyiv) and the Belarus (Minsk) with the aim of strengthening the existing scientific partnerships and developing new collaboration for long lasting synergy, and to enhance the scientific excellence of participating early stage and experienced researchers. The transfer of knowledge and forming of an intellectual "critical mass" will occur through theoretical exercises and laboratory research in the important and growing field of optical fibre biosensors, aiming towards applications in agriculture and taking opportunities offered by the latest achievements in nanotechnology and biotechnology. The challenge is to create a unique devices for detecting animal diseases, viruses and toxins using fundamental phenomena such as light absorbance, reflectance, transmittance, fluorescence and photoluminescence. The consortia have theoretical and experimental experience and specific skills for making advances in research on biosensors for agriculture applications. The aim is to amplify their knowledge and skills via joint research on specific tasks in work packages and to ensure the transfer of knowledge via seminars, workshops and summer schools and training courses. Through these, the results will be disseminated effectively and interactions will be stimulated amongst experienced researchers and community of young researchers, PhD and MSc students. Mutual research efforts and contacts, including cross-generation interactions, young researchers meetings and appropriate creative environment will grant necessary pre-conditions for sustainability of cooperation among consortia partners after the project is concluded. In total 164 secondment months are planned, 7 summer schools or training courses and 2 conferences.

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**NBR: 318529** **ACRONYM: POWERSWIPE** **EC FUND: 3295000**

**DG:** CNECT **Call: FP7-ICT-2011-8** **Thema:** ICT-2011.3.1

**Title:** POWER SoC With Integrated PassivEs

**Abstract:** Europe is a world leader in innovative automotive systems with competencies covering the full supply chain from the main OEMs (Audi, BMW, Daimler, Fiat, PSA, RSA, VW) to Tier1 suppliers (Bosch, Continental, Magneti Marelli) to leading semiconductor companies (Infineon, ST). The vision for electronic automotive control units in 2020 is that the battery will supply multi-core µControllers via multiple power supplies using an on-chip, granular power management system architecture, known as PowerSoC (Power Supply on Chip). The PowerSwipe proposal will address a key roadblock for PowerSoC

by, for the first time, miniaturising and integrating state-of-the-art, high density trench capacitor substrate technology with novel thin film magnetics on silicon to deliver a multi-component LC (inductor-capacitor) interposer which will be combined, in a 3D heterogeneous stack, using eWLB technology, with the µController chip. To achieve this miniaturisation of the power passives, the switching frequency of the switched mode dc-dc converter needs to be increased from the traditional 1 to 5 MHz space (with 90%+ converter efficiency) into the 20MHz to 100MHz+ range, at which point the footprint of the power passives is comparable to the footprint of the individual on-chip DC-DC converter blocks (i.e. 1 to 2mm2). PowerSwipe will deliver a European supply chain for PowerSoC by addressing the challenges of system design, engineering, technology and manufacturability of integrated power management systems or PowerSoC (Power Supply on Chip) for nanoCMOS System on Chip (SOC).

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**NBR: 318597** **ACRONYM: SYMONE** **EC FUND: 2120000**

**DG:** CNECT **Call: FP7-ICT-2011-8** **Thema:** ICT-2011.9.6

**Title:** SYnaptic MOlecular NEtworks for Bio-inspired Information Processing

**Abstract:** The SYMONE long-term vision is to build multi-scale bio-/neuro-inspired systems interfacing/connecting molecular-scale devices to macroscopic systems for unconventional information processing with scalable neuromorphic architectures. The SYMONE computational substrate is a memristive/synaptic network controlled by a multi-terminal structure of input/output ports and internal gates embedded in a classical digital CMOS environment. The SYMONE goal is the exploration of a multiscale platform connecting molecular-scale devices into networks for the development and testing of synaptic devices and scalable neuromorphic architectures, and for investigating materials and components with new functionalities. The generic breakthrough concerns proof-of-concept of unconventional information processing involving flow of information via short-range interactions through a network of non-linear elements: switches, memristors/synapses. These will require several breakthroughs concerning the functionality of reasonably complex networks of simple components, and the fabrication of networks of devices, including self-assembly and multi-scale interfacing/contacting between such networks. Memristive networks are expected to solve unconventional computational problems, e.g. solving maze problems and implementing dynamic multiplexers. The overall SYMONE objectives are to implement 2D memristic arrays and networks, establish multi-scale electrical connections, and to demonstrate bio-inspired functional behaviour in such systems. On the experimental side, SYMONE will work with lithographically defined NxN arrays of proven individual memristive elements (Nanoparticle Organic Memory FETs (NOMFETs), as well as self-assembled nanoparticle (NP) networks (NPSAN) with functionalised NPs. The theoretical aspects involve detailed physical and compact models for the network elements and networks, and schemes for elementary information processing with such

networks. SYMONE combines the advantages of a bottom-up approach based on molecular-scale objects and of a top-down approach based on functional modeling at the circuit level. The electronic properties of the nano-objects can be reproducibly modulated by the versatility of chemical synthesis. Such a solution is thus expected to provide continual scaling of device dimensions, or new architectures of electronics, or potential low-cost technologies, or all this together. SYMONE implements the vision of robust fault-tolerant information processing at molecular scale interfaced to conventional CMOS computers. The molecular-scale devices will be characterized and configured via post-fabrication learning without prior knowledge of the detailed structure of the self-assembled molecular network. This vision is also one of the very few routes for molecular scale information technology that does not suffer, from the start, from the same type of limitations as the ultimate CMOS technology with regard to ultra-dense computing applications.

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**NBR: 318617** **ACRONYM: FAEMCAR** **EC FUND: 142500**

**DG:** REA **Call: FP7-PEOPLE-2012-IRSES** **Thema:** FP7-PEOPLE-2012-IRSES

**Title:** Fundamental and Applied Electromagnetics of Nano-Carbons

**Abstract:** Owing to very small dimensions of nanostructures in one or more directions, spatial confinement of charge carriers is fully achieved, providing thereby a discrete spectrum of their energy states. In addition, intrinsic spatial inhomogeneity of nanostructures dictates nanoscale inhomogeneity of the surrounding electromagnetic fields. Therefore, understanding the properties of nanostructures requires to deal with the intricate characters of their atomic structure, electronic structure and electromagnetic environment. Coming within the scope of this new field of "nano-electromagnetics", the present project aims at understanding how and why carbon nanostructures might have interesting electromagnetic properties. The core of the project is the development, the experimental validation and the exploitation of a consistent theory of the electromagnetic response in radio, microwave and THz frequency ranges of regular carbon nano structures and polymer composites based on nanocarbons. In particular, the project intends to: - to provide a forum for scientists specialized in different areas of the nanocarbon, and nanocarbon materials synthesis and applications; - interpret experimental electromagnetic data collected; - define physical grounds and perform experiments for the design of a new generation of ultra-light materials with controlled electromagnetic properties; - explore the possibility of using chemically-modified nanocarbons in "thin" bio-medical and nanophotonics applications. At this aim, seven teams belonging to three different scientific areas will joint efforts. The partners will equally contribute to the achievements of the objective of this multi-disciplinary project by bringing their expertise in condensed-matter physics, electromagnetic theory, and applied electromagnetism. The research efforts, both theoretical and experimental, are

articulated around four work packages all involving strong collaborative links and knowledge transfer across the consortium.

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**NBR: 318625** **ACRONYM: NANOHEAT** **EC FUND: 3995000**

**DG:** CNECT **Call: FP7-ICT-2011-8** **Thema:** ICT-2011.3.1

**Title:** MultidomaiN plAtform for iNtegrated MOre-tHan-MoorE/Beyond CMOS systems charActerisation & diagnosTics

**Abstract:** For advanced nano-devices or Beyond-CMOS structures (sub-40nm transistors, SETs, graphene structures etc.) there is a deep shortage of versatile, multidomain tools capable of analysing phenomena occurring at a nanoscale. The family of AFM-based techniques provides a various nanoscale observation capabilities restricted however to dedicated, particular phenomena. Moreover, available AFM systems do not allow for easy "domain-mixing" as well as for combination of large distance and nanoscale positioning precision. These techniques are not useful as a in-line monitoring tools. The principle goal of the NANOHEAT project is to develop, deliver and validate a miniaturized and integrated platform which provides a multidimensional nanoprobing platform for advanced thermal analysis at the nanoscale. The multi-functional system of independently controlled AFM-based nanoprobes, equipped with dedicated (FIB functionalized) tips and actuators will allow for multi-domain diagnostics of nanoelectronic, nanophotonic and bio-electronic devices. The proposed system will allow to observe thermal, electrical (e.g. potential) or even chemical (e.g. electrochemical) properties at the nanoscale. It will also have in-line (on wafer) diagnostics capabilities. The consortium is composed of 3 R&D institutes, 4 university teams and 2 SMEs providing a mixture of a complementary expertise related to micro-engineering, design and technology of micro/nano-devices and systems, design and manufacturing of measurement and control electronics, modelling and simulation, material science and physics. Besides, four partners has an expertise and potential required for validation of the developed system for specific applications. The Coordinator, ITE is a leading Polish research centre active in the micro/nanoelectronic, micro/nano-system and photonic domains.

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**NBR: 318671** **ACRONYM: MICREAGENTS** **EC FUND: 3400000**

**DG:** CNECT **Call: FP7-ICT-2011-8** **Thema:** ICT-2011.9.6

**Title:** Microscale Chemically Reactive Electronic Agents

**Abstract:** The goal of the project is to give electronics and chemistry an equal autonomous say in programming complex chemical constructions, processes and analyses at the nano and microscales: the same scale where information processing in living systems occurs – where “to construct is to compute”. To do this MICREAgents (MIcroscopic Chemically Reactive Electronic Agents) will develop novel electronically active microreactor components, called lablets, that self-assemble at a scale less than 100 µm, approaching that of living cells. The project will integrate the necessary components to ensure autonomous action of millions of these “very smart chemicals”, including electronic logic, supercapacitors for power, pairwise coupling for communication, programmable chemical sensors and electronic actuation of chemical processing. Key examples of MICREAgent actuation are to reversibly switch their association, load or dose chemicals, modify surfaces, initiate reactions and control locomotion in complex chemical environments. MICREAgents lablets can join forces to communicate both chemicals and electronic information in order to solve complex tasks, acting as smart collective agents of chemical change. Like cells, they will be essentially genetically encoded, but with chemical and electronic memories, translating electronic signals into constructive chemical processing and recording the results of this processing. They will also reversibly employ DNA molecules as chemical information, for example to control surface-surface binding of lablets, or to program chemical sensors, not to synthesize proteins as in cells. The project builds on pioneering FET-funded work towards electronic chemical cells, taking a giant stride to cell-like microscopic autonomous chemical electronics with self-assembling electronic membranes controlling the entry and exit of chemicals. These autonomous mobile smart reactors will provide a novel form of computation that microscopically links reaction processing and chemical construction with computation, providing a radical integration of autonomous chemical experimentation. The self-assembling smart micro reactors can be programmed for molecular amplification and other chemical processing pathways, that start from complex mixtures, concentrate and purify chemicals, perform reactions in programmed cascades, sense completion, and transport and release products to defined locations. The project defines a continuous achievable path towards this ambitious goal, making use of a novel pairwise local communication strategy to overcome the limitations of current smart dust and autonomous sensor network communication. It will provide a technical platform spawning research in new computing paradigms that integrate multilevel construction with electronic ICT. The 10 groups, from 8 countries including Israel and New Zealand, are all pioneers in the multidisciplinary areas required to achieve the project goals, with a common grounding in IT.

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**NBR: 318804** **ACRONYM: SNM** **EC FUND: 12012000**

**DG:** CNECT **Call: FP7-ICT-2011-8** **Thema:** ICT-2011.3.1

**Title:** Single Nanometer Manufacturing for beyond CMOS devices

**Abstract:** To extend beyond existing limits in nanodevice fabrication, new and unconventional lithographic technologies are necessary to reach Single Nanometer Manufacturing (SNM) for novel 'Beyond CMOS devices'. Two approaches are considered: scanning probe lithography (SPL) and focused electron beam induced processing (FEBIP). Our project tackles this challenge by employing SPL and FEBIP with novel small molecule resist materials. The goal is to work from slow direct-write methods to high speed step-and-repeat manufacturing by Nano Imprint Lithography (NIL), developing methods for precise generation, placement, metrology and integration of functional features at 3 - 5 nm by direct write and sub-10nm into a NIL-template. The project will first produce a SPL-tool prototype and will then develop and demonstrate an integrated process flow to establish proof-of-concept 'Beyond CMOS devices' employing developments in industrial manufacturing processes (NIL, plasma etching) and new materials (Graphene, MoS2). By the end of the project: (a) SNM technology will be used to demonstrate novel room temperature single electron and quantum effect devices; (b) a SNM technology platform will be demonstrated, showing an integrated process flow, based on SPL prototype tools, electron beam induced processing, and finally pattern transfer at industrial partner sites. An interdisciplinary team (7 Industry and 8 Research/University partners) from experienced scientists will be established to cover specific fields of expertise: chemical synthesis, scanning probe lithography, FEBIP-Litho, sub-3nm design and device fabrication, single nanometer etching, and Step-and-Repeat NIL- and novel alignment system design. The project coordinator is a University with great experience in nanostructuring and European project management where the executive board includes European industry leaders such as IBM, IMEC, EVG, and Oxford Instruments.

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**NBR: 318899** **ACRONYM: PHOTOMAT** **EC FUND: 107400**

**DG:** REA **Call: FP7-PEOPLE-2012-IRSES** **Thema:** FP7-PEOPLE-2012-IRSES

**Title:** TUNABLE MATERIALS: PREPARATION, CHARACTERIZATION AND INVESTIGATION OF PHOTOCATALYTIC ACTIVITY OF NEW HIBRID MATERIALS

**Abstract:** This project aims at developing new materials with tunable properties, conjugating good mechanical properties and photocatalytic activity. New and advanced materials will be synthesized on purpose, characterized and their efficiency as photocatalysts in abating pollutants such as pesticides and emerging pollutants will be evaluated. In the first stage, inorganic materials (TiO2, CNTs, graphene oxide) will be prepared and tested both in dispersed phase or added into a polymeric coating. For such aim, doped semiconductor oxides and carbon nanotubes (alone or combined with oxides) will be synthesized and tested. We also plan to conduct a detailed study of the charge transfer processes in the hetero-junctions to evaluate the factors providing the best performance of the hybrid materials. In addition, the efficiency of surface photochemical processes will be estimated in terms of the quantum yield of surface chemical transformation. In the second stage, preparation and characterization of new

UV-cured polymeric materials containing at the same time CNTs or graphene and semiconductor oxides will be carried out, with the aim of exploring the synergistic/antagonist effect of the fillers in the photodegradative process followed by pollutants. For both stages, we plan on investigating the semiconductor properties of the inorganic material and its efficiency in the abatement of pollutants both when the catalyst is dispersed in water or when the target molecule is adsorbed on a polymeric film containing the catalyst dispersed into the network. The polymeric films will be employed for the degradation of pollutants in water or gas phases. In all cases, we will evaluate the initial degradation of the molecule, identify the transformation products and measure the toxicity of the system. Five multidisciplinary groups from Italy (University and Politecnico of Torino), Russia (University of Saint Petersburg), Spain (University of Madrid) and Canada (McGill University) are involved

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**NBR: 318901** **ACRONYM: COEF-MAGNANO** **EC FUND: 323400**

**DG:** REA **Call: FP7-PEOPLE-2012-IRSES** **Thema:** FP7-PEOPLE-2012-IRSES

**Title:** Coupling effects in magnetic patterned nanostructures

**Abstract:** The scientific objective of this programme is to achieve a comprehensive knowledge of magnetically coupled systems of reduced dimensionality. Spin configuration, magnetic and electrical properties of patterned nanostructures will be investigated in three kinds of magnetically coupled materials: antiferromagnetic / ferromagnetic (AF/FM), very thin multilayers with perpendicular anisotropy and superconducting / ferromagnetic (SC/FM) bilayers. Thin films will be patterned constraining lateral dimensions in the range of 50 nm to 200 microns. These dimensions are comparable to typical magnetic length scales as domain wall width and spin diffusion length, thus novel phenomena and spin configurations are expected as the size of these elements becomes smaller. Coupling interactions in patterned magnetic systems have attracted much attention due to both still open challenging issues in nanomagnetism and the technological implications in spintronics devices, storage media, biological sensor, and logic units. Four Work packages reveal the challenges and objectives of this proposal. The effect of magnetic coupling in: i) the formation of a vortex state in dots with an in-depth magnetic profile (FeF2/FeNi), ii) competing anisotropy nanostructures (IrMn/FeCo), iii) the domain configuration in YBaCuO/FM hybrid heterostructures, and iv) the stability of Co/CoFeB nanoelements with perpendicular anisotropy, will be systematically investigated. The proposed exchange scheme will train young and experienced researchers from eleven high-class research centers in state-of-the-art nanofabrication and characterization techniques. The success of this project is only possible combining capacities and facilities from all partners.

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**NBR: 318916** **ACRONYM: BRASINOEU** **EC FUND: 428400**

**DG:** REA **Call: FP7-PEOPLE-2012-IRSES** **Thema:** FP7-PEOPLE-2012-IRSES

**Title:** Translocation and Safe Design of Surface Engineered Metal oxide Nanoparticles

**Abstract:** BRASINOEU aims to study the translocation and nanosafety issues of engineered metal oxide nanoparticles (NPs).The new scientific and technology developments of nanotechnology require a deeper knowledge of the effects of nanotechnology based products on human health. This knowledge is fundamental for the development of nanotechnology and to achieve its full acceptance. The concept of "safe by design" is based on the application of nanosafety to design the nanomaterials in order to prevent or reduce their possible harm to humans and the environment. The project encompass the synthesis of metal oxide NPs, with a focus on magnetic oxides, their surface modification and post modification in biological fluids; immunological and genotoxicity studies, and translocation studies both "in vitro" and "in vivo". The project will seek to establish relationships between designed NP properties and their translocation at cellular and body level as well as their immune- and genotoxic response. This is a fundamental issue for the safe design of NPs. Also, the toxicological response will be studied as a function of the uptake dose of NPs. At cellular level a battery of techniques will be applied for localization and quantification of NPs: Transmission Electron Microscopy, Raman, Confocal Microscopy, Ion Beam Microscopy, etc. Positron Emission Tomography and Magnetic Resonance Imaging will be employed for biodistribution and quantification studies in animal models. BRASINOU is formed by an international team with the required and complementary expertise to address the proposed work from an international and multidisciplinary perspective. The project gathers internationally recognized groups in immunology, genotoxicity, nanoparticle synthesis, surface chemistry, biophysics, imaging and materials science. The complementary of the groups involved in the project will help to develop new highly skilled professional and scientific horizontal connections.

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**NBR: 318971** **ACRONYM: ECROBOT** **EC FUND: 520800**

**DG:** REA **Call: FP7-PEOPLE-2012-IRSES** **Thema:** FP7-PEOPLE-2012-IRSES

**Title:** European and Chinese Platform for Robotics and Applications

**Abstract:** The project "European and Chinese Platform for Robotics and Applications (ECROBOT)" focuses on the staff exchange between the partners of EU and China, and on the development of new technologies and applications in the field of robotics on the macro, micro and nano scales. It meets the objectives and requirements of the Marie Curie Action: International Research Staff Exchange Scheme (IRSES), by setting up multiple

bridges between European and Chinese institutions. The ultimate goal of ECROBOT is to establish a long-term research cooperation platform between Europe and China in the challenging field of Robotics with promising applications in scientific, industrial and domestic sectors. The synergistic approach made by ECROBOT will keep the consortium's leading position in the world for potential major scientific and technological breakthroughs. The project is divided into five inter-related workpackages: (1) Setup of knowledge base and road mapping, (2) Fundamental exploration of robotics, (3) Development of robot systems, (4) Dissemination and exploitation, and (5) Project management. The workpackages integrate all activities that will lead to the completion of all the project objectives within 36 months.

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**NBR: 318977** **ACRONYM: PHOCSCLEEN** **EC FUND: 163800**

**DG:** REA **Call: FP7-PEOPLE-2012-IRSES** **Thema:** FP7-PEOPLE-2012-IRSES

**Title:** PHOtoCathalytic Systems for CLean Energy and Environment Applications

**Abstract:** The research purpose of PHOCSCLEEN is to investigate a number of photo-catalytic oxide nanomaterials, classify them and produce new composite materials with tailored properties. Selected materials will be investigated in the light of application aimed to environmental clean-up and water splitting for hydrogen production. By exploiting the complementarities of partners, the following goals will be reached: 1. Improvement of the technical knowledge in the area, achieved thanks to a systematic characterization of the properties and processing of photo-catalytic oxide nanomaterials, and by investigating and optimizing the integration schemes of optical energy sources within the photocatalytic reactor, 2. Increase of the cooperation among the participating institutions and, more in general, between Europe, Canada and Mexico in this area; besides the support to the joint research among senior researchers (ERs), this will be achieved by training young researchers (ESRs) not only from a scientific point of view, but also enhancing their ability to work within an international team combining expertise coming from different research centers; 3. Support to and ease of the transfer of the existing expertise from one partner to another, both in terms of knowledge, and in terms of expertise on tools and processes. Eventually this will lead to the creation of a structured network of institutions cooperating in this area. This will also include the transfer of know-how in project setup and management to allow for the construction of a stronger management base to better define and guide future EU projects on the mentioned research area.

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**NBR: 318990** **ACRONYM: ELETRONANOMAT** **EC FUND: 287700**

**DG:** REA **Call: FP7-PEOPLE-2012-IRSES** **Thema:** FP7-PEOPLE-2012-IRSES

**Title:** Molecular Scale Electrochemistry and Nontraditional Electrochemical Materials Science

**Abstract:** ELECTRONANOMAT offers major efforts towards establishing and developing a new joint European/Chinese network in comprehensive frontline electrochemical and biological surface science. The network will be a platform for future collaboration based on extensive staff exchange and knowledge transfer among the partner institutions. “Molecular and biomolecular electrochemistry at non-traditional electrode surfaces” is a core notion, rooted in designed electrocatalytic materials with new and interesting properties. The materials are metallic and semiconductor nanoparticle, graphene, and photo-active composite materials, as well as ionic liquid media, prepared by tailored chemical synthesis and characterised to nanoscale and single-atom/molecule resolution by sophisticated physical techniques. The new materials are the basis for multifarious, coordinated efforts in precisely defined joint projects in molecular and biomolecular electrochemistry, single-molecule scanning probe studies, photo-electrocatalysis, and nanomaterial/(bio)molecular hybrids, accompanied by strong theoretical support. Core achievements will include detailed understanding of electronic and transport properties of single “smart” molecules (transition metal complexes, redox metalloproteins) in novel environments, and electrochemical mapping of electronic properties of the new materials alone and in combination with “smart” (bio)molecules. Development of next generation ultra-sensitive chemical and bioelectrochemical sensor devices based on the novel interdisplinary surface science is also offered by the European/Chinese collaboration. The eight strong Chinese and European groups offer all complementary expertise in chemical synthesis, surface characterization, electrochemistry, scanning probe technology, and theoretical expertise needed for the proposed coordinated effort. In return the project will lift molecular and biomolecular electrochemistry and surface science to a new European/Chinese-based level.

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**NBR: 319013** **ACRONYM: SICCATALYSIS** **EC FUND: 165300**

**DG:** REA **Call: FP7-PEOPLE-2012-IRSES** **Thema:** FP7-PEOPLE-2012-IRSES

**Title:** Porous Silicon Carbide as a support for Co metal nanoparticles in Fischerâ€“Tropsch synthesis

**Abstract:** Searching for the alternative energy sources and particularly for liquid fuel is strategic task for the nearest future. Renewable biomass, large deposits of natural gas and coal can be such sources. A major challenge for this direction is to develop efficient the gas-to-liquid process. The heart of such process is Fischer-Tropsch (FT) synthesis (CO hydrogenation by hydrogen) that takes place on Co or Fe catalysts supported on Al2O3 or SiO2. The FT reaction is usually carried out at 200 - 350 °C and at elevated pressures (up to 40 bars). At these stress conditions the chemical nature of the support material

plays an important role. Significant support interaction is observed for Al2O3 and TiO2 leading to the formation of inactive compounds (so-called SMSI effect). SiO2 support exhibits a weaker interaction. However, its low thermal conductivity provokes overheating of the metals due to a high exothermic nature of the FT reaction. It leads to sintering of the active compounds. Consequently, these effects cause irreversible deactivation of the catalyst. The main objective of the proposed project is the development of new catalysts which demonstrate high activity/selectivity with improved stability towards extreme hydrothermal conditions in FT reaction. To do so, we propose to apply porous silicon carbide (pSiC) as a support in the catalyst. The use of pSiC prevents sintering and chemical reaction of cobalt metal with a support thanks to its high thermal conductivity, outstanding chemical inertness and mechanical strength. Moreover, silicon carbide demonstrates mesoporous framework enabling its impregnation with cobalt particles. This will lead to higher activity/selectivity in comparison to nonporous supports in terms of mass unit of the catalyst. For more benefit concepts of nanotechnology in catalyst preparation will be introduced to control the size and shape of cobalt nanoparticles, known as hot injection method.

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**NBR: 319054** **ACRONYM: NANOEIS** **EC FUND: 518176**

**DG:** RTD **Call: FP7-NMP-2012-CSA-6** **Thema:** NMP.2012.1.4-5

**Title:** Nanotechnology Education for Industry and Society

**Abstract:** Nanotechnology is an emerging area with strong implications for European society and industry. It is a challenge for the education system to integrate this interdisciplinary and transsectoral subject into curricula shaped mostly along classical disciplines. NanoEIS will evaluate how nanotechnology education has been integrated into secondary schools and universities, how cooperations between different partner institutions were implemented, and in which ways industrial and non-industrial (social) employers have been involved. NanoEIS will make, based on a thorough assessment of employer needs, recommendations for curriculum contents as well as for best practice strategies to implement them. This will help to resolve the problem that education contents are not always well matched with the needs of the job market. Improving this situation will benefit both graduates seeking jobs, and industrial / social employers who need specific skills in the professional environment. Nanotechnology education has to start at secondary schools, since nano is by now part of the daily environment and schools need to teach about relevant issues to allow informed consumers to take full advantage of nano-enabled products in a safe and sustainable way. NanoEIS will develop novel teaching and assessment tools for secondary schools. In addition, career choices start in school when decisions about study subjects are made, which should be based on full and relevant information, to achieve a good match between the interests of students and the contents of their studies and courses. A website based on the existing NANOfutures site will be set up, as one-stop shop for information on nanotechnology education for all

stakeholders, including secondary school students, university students, educators and education administrators, and both industrial (large industry, SME, start-ups) and social employers (regulatory agencies, media, legal and IP services etc.).

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**NBR: 319092** **ACRONYM: NANOSTAIR** **EC FUND: 499437**

**DG:** RTD **Call: FP7-NMP-2012-CSA-6** **Thema:** NMP.2012.4.0-2

**Title:** Establishing a process and a platform to support standardization for nanotechnologies implementing the STAIR approach

**Abstract:** Standardization is one of the most adequate solutions to quickly capitalize and disseminate knowledge in “reference documents”, and have it implemented in the industry. It is very important in the field of nanotechnologies since the production of knowledge is very intensive. The overall objective of nanoSTAIR project is to build a sustainable process and platform in the field of nanotechnologies to support the transfer of knowledge gained through research to documentary standards in the context of the STAIR approach promoted by CEN-CENELEC. The project is organized around several activities that will boost the development of new documentary standards. A mechanism will be set up to identify, with a bottom-up approach, the opportunities for standardization from the results of research projects, co-funded by the European Commission or by National Research Programmes. This mechanism will be established using existing networks and initiatives such as NanoSafetyCluster or NANOfutures, as well as the network of the national standardization bodies in the various Member States. Then, the expression of the needs for standards from various stakeholders will be collected and resources from consortia sharing similar standardization opportunities will be pooled together to launch New Work Items Proposals (NWIP). The nanoSTAIR approach will be verified during the project thanks to 2 NWIP initiated. The consortium will provide assistance to select the right standardization umbrella (Technical Committee and Working Group at CEN or ISO level) As a result, nanoSTAIR will provide a set of procedures, a tool box and a practical guideline that will be useful to bridge the gap between research and standardization in nanotechnologies. nanoSTAIR will structure and ease the development of new documentary standards, and thus enable the European nanotechnology related industry to rapidly operate according to the state of the art and thus increase its competitiveness.

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**NBR: 319114** **ACRONYM: ENF 2013** **EC FUND: 599913**

**DG:** RTD **Call: FP7-NMP-2012-CSA-6** **Thema:** NMP.2012.4.0-4

**Title:** EuroNanoForum 2013 Nanotechnology Innovation: From research to commercialisation â€“ the bridge to Horizon2020

**Abstract:** The EuroNanoForum 2013 Nanotechnology Innovation: From research to commercialisation – the bridge to Horizon2020 conference is proposed to be held in Dublin during the Irish presidency of the European Union. It will be organised by Enterprise Ireland, the Government organisation responsible for the development and growth of Irish enterprises in world markets. The conference will be held from June 18th to June 20th 2013. The first 2 days of the conference will feature plenary sessions, presentations, workshops and several accompanying activities which will be used to explore the scientific, industrial and societal issues targeted by the conference. A third day will be used to foster networking at the various levels using industrial and research centre visits, a brokerage event and an investor's forum. The main focus of the conference will be the commercialisation of nanotechnology, exploiting its potential for new applications, pushing it from an enabling technology through to development and on to end product use. With Horizon2020 and its new structure beginning in 2014 the conference will be used to look at how nanotechnologies will fit into the targeted key priority areas of Excellent Science, Industrial Leadership and Societal Challenges. ENF2013 will be part of the official Irish EU presidential calendar hosted by the Office of Science and Technology of the Department of Jobs Enterprise and Innovation.

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**NBR: 319192** **ACRONYM: COM´N&N** **EC FUND: 243000**

**DG:** RTD **Call: FP7-NMP-2012-CSA-6** **Thema:** NMP.2012.1.4-4

**Title:** Supporting N&N research communication, dialogue and engagement

**Abstract:** Evaluating EC communication and dialogue developed so far on nanoscience and nanotechnology (N&N) is crucial to identify future areas for improvement. Measuring the effectiveness of these efforts is still a relatively new field, and emerging evaluation techniques are grappling with how to deal with. Under a comprehensive (formative, process, outcome and impact) evaluation focus, Com'N&N proposes the following specific objectives to be achieved: 1. Gathering data and evidence that guided the design of the N&N communication and dialogue actions, including information on ways that was shaped; 2. Measuring N&N communication and dialogue's implementation and how planned activities have been carried out; 3. Measuring shorter term changes in beliefs, attitudes and behavior within the target audiences after exposure to N&N communication and dialogue activities; 4. Identifying longer-term effects of behavior that can be made after exposure to the N&N communication and dialogue activity. The following measurable results will be achieved by Com'N&N: • List of 25 indicators covering the spectrum of focus; • List of 7.500 potential surveyed participants • Obtaining approx. 15% of participants (1.150) completing the 10-15 minutes web survey; • Sample of 100 interviewees covering most of the 160 matrix segments among type of

messages + communication vehicles + audience target; • Combined use of analytical techniques: concatenation, statistics and SWOT; • Recommendations based on 10 case studies and good practices of communication efforts carried out during the period 2008-2011; • Dissemination of 75 paper final evaluation report; 500 leaflets promoting evaluation of communication efforts in N&N and recognizing a selection of case studies and good practices; and, 500 visitors of the website having downloaded at least 1 public deliverable. This proposal is submitted by independent, specialized consultancies ensuring a neutral approach from stakeholders interest.

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**NBR: 319208** **ACRONYM: NANOINDENT-PLUS** **EC FUND: 380000**

**DG:** RTD **Call: FP7-NMP-2012-CSA-6** **Thema:** NMP.2012.4.0-2

**Title:** Standardising the nano-scratch test

**Abstract:** This project will further develop, validate and draft standards for nano-scratching, which is an important new tool to investigate the tribological properties of materials on a scale relevant to the fundamental mechanisms of wear. It will facilitate the development of new coatings and engineered surfaces that will give impact through improved competitiveness of industry and a better quality of life for EU citizens. Nano-scratching clearly operates at a different length scale to macro- and micro-scratch tests, but can be a straightforward extension of the capability of nanoindentation equipment. This is an area where European industry is very strong, three European SMEs have a dominant role in production of such instruments. In scratching a sharp, stiff tool is moved on the surface of the sample while a normal force is applied on the tool tip. At different threshold values of the force the tip penetrates into the sample by various mechanisms. These threshold forces, or more precisely the stresses that are generated at these thresholds, are characteristic parameters for the failure of the substrate-coating system in question. Test procedures and software for nano-scratching are in their infancy compared to those for nanoindentation. Development of nanoindentation equipment started on a firm theoretical basis, while nano-scratching (as macro-scratching) has no uniform methodology till now. One part of the NANOINDENT FP-7 project (NMP3-CA-2008-218659) dealt with the development of nano-scratching metrology, guidelines for determining scratching data were constituted. Based on these studies, NANOINDENT partners have set up this new proposal to start a standardisation process. The overall aim of the project is to draft a New Working Item Proposal (NWIP) for a standard in nano-scratching that will be submitted to the appropriate CEN technical committee (TC 352) through a workshop of the main European stakeholders from industry, academia, and research organizations.

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**NBR: 319968** **ACRONYM: FFLOWCCS** **EC FUND: 2200000**

**DG:** ERCEA **Call: ERC-2012-ADG_20120216** **Thema:** ERC-AG-PE3

**Title:** Fluid Flow in Complex and Curved Spaces

**Abstract:** In many natural and industrial situations, fluids in cavities, membranes or pipes of complex shape grow as well as modify the structures through which they flow. This leads to important challenges both fundamental, like biological morphogenesis, and practical, like the motion of nano-electromechanical systems (NEMS). We seek to substantially advance the understanding of the resulting shapes and instabilities. Our approach will focus on numerical methods, validated through theoretical and experimental analysis. Mathematically fluid-structure interactions involve ambitious moving boundary problems, where structure and fluid flow feedback on one another in complex ways. Detailed analysis requires precise modeling of coupling between very strongly de¬forming elasto-plastic solids and fluid flow in intricately curved spaces and solving both iteratively many times. To address this computational challenge, significant innovations will be implemented, including the use of novel erosion laws, the insertion of spatial curvature and metric directly into the equations of motion of the fluid, and special methods to handle the singular behaviour at kinks and constrictions. Our fluid solvers will be new variants of Lattice Boltzmann Models (LBM) coupled to temperature and concentration fields. The accuracy of the methods will be quantitatively validated by experiments. An unconventional hydrodynamic formulation for electronic currents will provide big advantages. We will develop LBM solvers for quantum and relativistic fluids and in particular create a Lattice Wigner model and couple it to the molecular dynamics of the support. Our method will open new horizons for the design of continuously regenerating filters, for shape optimi¬zation of heat exchangers and catalysts and for the engineering of electronic devices. Our approach will also shed light on sand avalanches in oil extraction, on aspects of folding in living matter, and on electromechanical instabilities.

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**NBR: 320004** **ACRONYM: SILICON EUROPE** **EC FUND: 2771334**

**DG:** RTD **Call: FP7-REGIONS-2012-2013-1** **Thema:** REGIONS-2012-2013-1

**Title:** Developing a leading-edge European Micro- and nanoelectronics cluster for energy efficient ICT

**Abstract:** Four of the leading European micro- and nanoelectronics regions are joining their research, development and production expertise to form the transnational, research-driven cluster “Silicon Europe”. Involved in this national “triple-helix” consortia are the following high-potential mature clusters: the German Silicon Saxony, centred in Dresden, the Dutch Point-One, centred around Eindhoven in the South Eastern part of the Netherlands, France’s Minalogic, centred in Grenoble, and Belgium’s DSP Valley,

centred at Leuven. The Silicon Europe partners are linked by a common goal: to make Europe the world's leading centre for energy efficient electronics – Silicon Europe – The Leaders for Energy Efficient ICT Electronics The involved clusters in total have nearly 800 members , most of them (more than 75%) are SMEs, and count for more than 150.000 jobs (covering thereby more than 60% of the respective jobs in Europe) . They combine highly relevant research actors such as imec, CEA-Leti and Fraunhofer as well as large companies such as Philips, NXP, Globalfoundries, Infineon, STMicroelectronics and Thales. All involved clusters cover the full triple helix. Within Silicon Europe, following an in-depth analysis, joint action plans will be developed for concerted research in the field including the development of regional smart specialisation strategies and a internationalisation strategy for the involved clusters. Silicon Europe has as its ambition to place Europe in a leading position in research and development for the key enabling technology of Micro- and Nanoelectronics by using the full potential of synergy and complementarities of the existing high-potential clusters in France, Germany, Belgium and the Netherlands and potentially other European clusters. The extension of the collaboration between the clusters towards a Joint Action Plan on local as well as on European level and its implementation will have a major impact on the competiveness of the entire sector.

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**NBR: 320081** **ACRONYM: PHOTOMETA** **EC FUND: 2100000**

**DG:** ERCEA **Call: ERC-2012-ADG_20120216** **Thema:** ERC-AG-PE3

**Title:** Photonic Metamaterials: From Basic Research to Applications

**Abstract:** Novel artificial materials (photonic crystals (PCs), negative index materials (NIMs), and plasmonics) enable the realization of innovative EM properties unattainable in naturally existing materials. These materials, called metamaterials (MMs), have been in the foreground of scientific interest in the last ten years. However, many serious obstacles must be overcome before the impressive possibilities of MMs, especially in the optical regime, become real applications. The present project combines NIMs, PCs, and aspects of plasmonics in a unified way in order to promote the development of functional MMs, and mainly functional optical MMs (OMMs). It identifies the main obstacles, proposes specific approaches to deal with them, and intends to study unexplored capabilities of OMMs. The project objectives are: (a) Design and realization of 3d OMMs, and achieve new metasurface designs applying Babinet's principle. (b) Understanding and reducing the losses in OMM by incorporating gain and EM induced transparency (EIT). (c) Achieving highly efficient PC nanolasers and surface plasmons (SPs) lasers. (d) Use chiral MMs and SPs to reduce and manipulate Casimir forces, and (e) Using MMs, combined with nonlinear materials, for THz generation, and tunable response.(f)Calculate electron-phonon scattering and edge collisions in graphene and in graphene-based molecules. The unifying link in all these objectives is the endowment of photons with novel properties through imaginative use of EM-field / artificial-matter interactions. Some of

these objectives seem almost certainly realizable; others are more risky but with higher reward if accomplished; some are directed towards new specific applications, while others explore new physical reality. The accomplishment of those objectives requires novel ideas, advanced computational techniques, nanofabrication approaches, and testing. The broad expertise of the PI and his team, and their pioneering contributions to NIMs, PCs, and plasmonics qualifies them for facing the challenges and ensuring the maximum possible success of the project.

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**NBR: 320372** **ACRONYM: PISA** **EC FUND: 2480300**

**DG:** ERCEA **Call: ERC-2012-ADG_20120216** **Thema:** ERC-AG-PE5

**Title:** Polymerisation-induced self-assembly

**Abstract:** The efficient, reproducible synthesis of bespoke organic nanoparticles of controlled size, morphology and surface functionality in concentrated solution is widely regarded to be a formidable technical challenge. However, recent advances by the Principal Investigator (PI) suggest that this important problem can be addressed by polymerisation-induced self-assembly (PISA) directly in aqueous solution to form a range of diblock copolymer 'nano-objects'. The proposal combines three synergistic themes within the PI's group: (i) controlled-structure water-soluble polymers, (ii) living radical polymerisation and (iii) novel polymer colloids. More specifically, the PI will work closely with four post-doctoral scientists and a PhD student to design a series of diblock copolymer nanoparticles with either spherical, worm-like or vesicular morphologies under dispersion polymerisation conditions in either water, alcohol or n-alkanes. This exciting and timely fundamental research programme will produce world-leading scientific innovation. Moreover, the targeted nanoparticles will be evaluated for various potential applications, such as (i) intracellular delivery of various biomolecules (e.g. DNA, proteins, antibodies), (ii) readily sterilisable biocompatible hydrogels, (iii) bespoke Pickering emulsiifiers and foam stabilisers, (iv) tough nanocomposite monoliths, (v) new components for next-generation paints, (vi) novel boundary lubricants for high performance engine oils. Informal collaborations with four academic partners and four industrial companies will ensure that maximum scientific value and economic impact is extracted from this ambitious work programme. All research findings will be published in top-quality scientific journals and the PI will provide appropriate mentoring to inspire his research team to become the next generation of creative, productive scientists for the EC.

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**NBR: 320404** **ACRONYM: MEMSFORLIFE** **EC FUND: 2492400**

**DG:** ERCEA **Call: ERC-2012-ADG_20120216** **Thema:** ERC-AG-PE8

**Title:** Microfluidic systems for the study of living roundworms (Caenorhabditis elegans) and tissues

**Abstract:** This proposal situated at the interfaces of the microengineering, biological and medical fields aims to develop microfluidic chips for studying living roundworms (Caenorhabditis elegans), living cultured liver tissue slices obtained from mice, and formaldehyde/paraffin-fixed human breast cancer tissue slices and tumors. Each type of microfluidic chip will be the central component of a computer-controlled platform having syringe pumps for accurate dosing of reagents and allowing microscopic observation or other types of detection. From an application point-of-view the work is focused on five objectives: (i) Development of high-throughput worm chips. Our goal is to build worm tools that enable high-throughput lifespan and behavioral measurements at single-animal resolution with statistical relevance. (ii) Linking on-chip microparticles (beads) to the C. elegans cuticle. We will use beads with electrostatic surface charges and beads that have a magnetic core for quantification of locomotion and forces developed by the worms. Moreover high-refractive index microspheres will be used as in situ microlenses for optical nanoscopic worm imaging. (iii) Realization of a nanocalorimetric chip-based setup to determine the minute amount of heat produced by worms and comparison of the metabolic activity of wild-type worms and mutants. (iv) Study of precision-cut ex vivo liver tissue slices from mice, in particular to evaluate glucose synthesis. The slices will be perifused with nutrients and oxygen in a continuous way and glucose detection will be based on the electrochemical principle using microfabricated electrodes. (v) On-chip immunohistochemical processing and fluorescent imaging of fixed clinical tissue slices and tumorectomy samples. These systems aim the multiplexed detection of biomarkers on cancerous tissues for fast and accurate clinical diagnosis.

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**NBR: 320459** **ACRONYM: DROPLETCONTROL** **EC FUND: 2409773**

**DG:** ERCEA **Call: ERC-2012-ADG_20120216** **Thema:** ERC-AG-PE2

**Title:** Controlling the orientation of molecules inside liquid helium nanodroplets

**Abstract:** In this project I will develop and exploit experimental methods, based on short and intense laser pulses, to control the spatial orientation of molecules dissolved in liquid helium nanodroplets. This idea is, so far, completely unexplored but it has the potential to open a multitude of new opportunities in physics and chemistry. The main objectives are: 1) Complete control and real time monitoring of molecular rotation inside liquid helium droplets, exploring superfluidity of the droplets, the possible formation of quantum vortices, and rotational dephasing due to interaction of the dissolved molecules with the He solvent. 2) Ultrafast imaging of molecules undergoing chemical reaction dynamics inside liquid helium droplets, exploring rapid energy dissipation from reacting molecules to the helium solvent, transition between mirror forms of chiral

molecules, strong laser field processes in He-solvated molecules, and structure determination of non crystalizable proteins by electron or x-ray diffraction. I will achieve the objectives by combining liquid helium droplet technology, ultrafast laser pulse methods and advanced electron and ion imaging detection. The experiments will both rely on existing apparatus in my laboratories and on new vacuum and laser equipment to be set up during the project. The ability to control how molecules are turned in space is of fundamental importance because interactions of molecules with other molecules, atoms or radiation depend on their spatial orientation. For isolated molecules in the gas phase laser based methods, developed over the past 12 years, now enable very refined and precise control over the spatial orientation of molecules. By contrast, orientational control of molecules in solution has not been demonstrated despite the potential of being able to do so is enormous, notably because most chemistry occurs in a solvent rather than in a gas of isolated molecules.

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**NBR: 320503** **ACRONYM: LINASS** **EC FUND: 2049999**

**DG:** ERCEA **Call: ERC-2012-ADG_20120216** **Thema:** ERC-AG-PE3

**Title:** Light-induced NanoAssembly

**Abstract:** NanoMaterials have huge promise in a wide range of applications of societal importance. Intricate combinations of metals, semiconductors, dielectrics, and molecular components in three-dimensional configurations, have new and unusual properties. Such advanced functions are at the heart of photovoltaics, magnetic and quantum information technologies, photosynthesis, water splitting, electronics, batteries, fuel cells, catalysis and many more crucial areas. Despite much research, we simply cannot yet make such nanomaterials at will. This problem is thus a major challenge for the future decades that we need to solve. The proposal here uses bottom-up assembly of nano-components combined with the application of controlling beams of light, as a new approach to sub-nm precision capable of scale-up. The exact arrangement of nano-sized components can drastically change the optical response of a nanostructure. We directly exploit this optical sensitivity to structure. Irradiation by specific wavelengths of laser light builds up strong optical fields only in parts of the structure which transiently have the right configuration. These regions of high field can be spatially localised to 1nm, far smaller than the wavelength of light. If this induces enhanced binding then optical selection preferentially selects specific morphologies. The principal goal of this proposal is to demonstrate the new strategies for reliable nano-constructs at the 1nm scale, which can be produced in large numbers with essentially identical architecture. Several approaches will be explored in parallel, using the light to either glue together nano building blocks, or to deposit the energy needed to grow nanostructures directly. In addition developing ways for light to flex structures can result in significant changes to the optical spectra, thus providing exquisitely-sensitive

feedback on the nanoscale. Light is a crucial observational tool, requiring development of real-time sub-ms spectroscopies.

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**NBR: 320539** **ACRONYM: DUPLEX** **EC FUND: 2457946**

**DG:** ERCEA **Call: ERC-2012-ADG_20120216** **Thema:** ERC-AG-PE5

**Title:** Programmable Plastics

**Abstract:** The unique properties of nucleic acids have made them the material of choice for complex nanofabrication. High fidelity formation of duplexes via non-covalent interactions between complementary sequences provides a straightforward approach to molecular programming of multicomponent self-assembly processes. The structure of the nucleic acid backbone and bases can be changed without destroying these properties, suggesting that there are all kinds of unexplored polymeric structures that will also show sequence selective duplex formation. This proposal investigates this rich new area at the interface of supramolecular, biological and polymer chemistry. The appeal of nucleic acids is that we can dial up any desired sequence via chemical solid phase synthesis or via biological template synthesis. With recent advances in polymerisation processes, which proceed under mild conditions compatible with non-covalent chemistry, we are now in a position to develop comparable processes for synthetic polymers. This proposal explores a ground-breaking approach to the synthesis of polymeric systems equipped with defined sequences of recognition sites. The aim is to establish protocols for routine solid phase synthesis of one class of oligomer, which can be used to template the synthesis of different classes of oligomer. This template chemistry will provide tools for polymerisation of conventional monomers using templates to determine the sequence of recognition sites and hence incorporate the selective recognition properties of nucleic acids into bulk polymers like polystyrene. The ability to program polymers with recognition information will open the way to new materials of unprecedented complexity and functionality with applications in all areas of nanotechnology where precise control over macromolecular structure and supramolecular organisation will be used to program mechanical, photochemical and electronic properties into sophisticated assemblies that rival biology.

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**NBR: 320570** **ACRONYM: EXCIPOL** **EC FUND: 2100000**

**DG:** ERCEA **Call: ERC-2012-ADG_20120216** **Thema:** ERC-AG-PE3

**Title:** Exciton-Polaritons: New Physics and Long Term Applications

**Abstract:** This proposal combines novel experimentation and physical insight with state-of-the-art advances in technology to establish the field of exciton-polariton physics in major new directions. The new physics takes advantage of unique polariton properties including very light mass, strong non-linearities, bosonic character and direct access to density, phase and quantum statistics. The major goals are: 1. Transform the field into the regime of non-classical polariton physics. Major steps forward will include the polariton blockade where one polariton prevents the passage of the next, and very fast 10-100 GHz single photon sources, opening the way to realisation of a variety of strongly correlated photon phenomena in a solid state system. 2. Achieve a quantum phase transition in a system with strong inter-particle interactions, with particular opportunities deriving from the non-equilibrium nature of the polariton system. 3. In the many particle regime, create non-dispersing polariton wave-packets, study collisions and create the first polariton circuits, capitalising on advantageous soliton and condensate properties. As well as the polariton area, the project will impact on several broader fields: semiconductor physics in revealing new interaction phenomena on the nanoscale, quantum optics and information science in the realisation of very fast single photon sources and quantum circuit functions, and new high density collective phase physics towards exploitation as opto-electronic logic gates and circuits. Advances in technology will be crucial to enable the new directions. They will include fabrication of highly uniform cavities using innovation in crystal growth, the pioneering of a new type of polariton system, waveguide polaritons, and the use of open cavities to permit the application of very short wavelength periodic potentials. These technology goals are challenging but achievable, and have potential to enable major advances over the next 5 to 10 years.

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**NBR: 320750** **ACRONYM: NANOPALEOMAG** **EC FUND: 2384543**

**DG:** ERCEA **Call: ERC-2012-ADG_20120216** **Thema:** ERC-AG-PE10

**Title:** Nanopaleomagnetism: a multiscale approach to paleomagnetic analysis of geological materials

**Abstract:** Paleomagnetism has played a pivotal role in developing our modern understanding of the Earth, and remains one of the primary tools used to study the structure and dynamics of the Earth and other planets. However, some of the most interesting and controversial periods of Earth's history occur far beyond the current limits of our confidence in the paleomagnetic signals used to study them. NanoPaleoMag will solve this problem by dramatically increasing the range of materials that are suitable for paleomagnetic study, thereby opening up periods of Earth history that have hitherto defied conventional paleomagnetic analysis. Rocks are chemically, mineralogically, texturally and magnetically heterogeneous materials, with heterogeneity occuring at all length scales – from metres to nanometres. There is a pressing need to push the spatial resolution of paleomagnetic studies beyond their current limits and to extend the

analysis into 3D. Adopting cutting-edge techniques from physics and materials science, NanoPaleoMag will perform paleomagnetic measurements at submicron length scales. 3D measurements of the volume, shape and spacing of all magnetic particles within a microscale region of interest will be made using a focused ion beam workstation. Combined with high-resolution paleomagnetic measurements and nanometre/nanosecond electron/X-ray magnetic imaging, NanoPaleoMag will characterise the magnetic properties of geological materials at fundamental length scales and time scales. Sample-return missions to asteroids, comets, moons and planets will soon provide unprecedented opportunities for extraterrestrial paleomagnetism. NanoPaleoMag will provide the methodology and instrumentation needed to analyse these precious materials.

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**NBR: 320774** **ACRONYM: NANOOXIDES** **EC FUND: 1128400**

**DG:** ERCEA **Call: ERC-2012-ADG_20120216** **Thema:** ERC-AG-PE5

**Title:** Nanosized porous molecular metal oxides with functionalizable cavities and soft matter behaviour allow studies of new phenomena

**Abstract:** It is generally accepted that nano materials “will revolutionize our industries and our lives” (Nobel laureate R. Smalley). We wish to extend our work on unique metal-oxide nano materials, which offer signposting routes due to their structures/forms – like our worldwide highlighted and used spherical capsules with 20 gated pores – to study novel phenomena with impact for basic research as well as applications. These nano materials should now be adjusted regarding size, chemical composition, their linking to extended structures, and a variety of new tailored internal functionalities in order to get appropriate properties of interest for different purposes of nano science and technology. Among the examples are: the protection/stabilization of intermediates and transport of the encapsulated materials after pore closing, systematic studies regarding the generation of hydrophobic cavities with and without water (of importance for protein research and even related to drug design), the removal of a variety of hydrophobic (potentially toxic) compounds from water based on molecular recognition (a paradigmatic shift) and finally, stepwise capsule closing and opening related to allosteric effects. The intended work on the capsules should open doors for the understanding of phenomena in small spaces. Also materials based on the related wheel-shaped metal-oxides with unprecedented properties (i.e. soft matter behaviour) will be investigated.

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**NBR: 320796** **ACRONYM: MODPHYSFRICT** **EC FUND: 1550000**

**DG:** ERCEA **Call: ERC-2012-ADG_20120216** **Thema:** ERC-AG-PE3

**Title:** Modeling the Physics of Nano-Friction

**Abstract:** In the next five years, novel nanoscale friction experiments will provide decisive data on the physics of a century-old, central, yet incompletely understood area of physics. Nano and mesoscopic phenomena without historical precedent in classic friction are emerging in tip based and other sliding and dissipation measurements. Opportunities for the control of friction, based on harnessing and modifying collective phenomena in the substrate are in the works; and fresh spectroscopic insights into the quantum phenomena in solids and surfaces are currently obtained by nanofrictional means. Finally, exciting laser based sliding nanosystems just appeared. All this experimental opulence demands a strong matching theoretical effort: and just that is the scope of this project. I and my group will model, calculate and simulate the frictional anomalies accompanying structural and ferroelectric phase transitions as an opportunity for friction control; and will pursue the noncontact dissipation anomalies as a local spectroscopic tool of electronic, magnetic and quantum transitions. A strong priority will be the theory and simulation of sliding in trapped colloids and cold ions on laser generated periodic potentials, where nanoscale and mesoscale sliding phenomena promise to be uniquely accessible. The range of approaches will cover phenomenology, model building and testing, molecular dynamics atomistic simulations of sliding, both empirical and ab initio, electronic and magnetic dissipation modeling; and ordinary condensed matter theory, along with non-equilibrium statistical mechanics. To achieve that scope, I will put together students, postdocs, and leading condensed matter theorists operating mostly in SISSA Trieste, but also in ICTP Trieste and elsewhere, assembling a strong team in good contact with European experimental groups. Their complementarity will allow this unified project to attain results much beyond what the team members could individually achieve.

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**NBR: 320832** **ACRONYM: IMAGINE** **EC FUND: 2499140**

**DG:** ERCEA **Call: ERC-2012-ADG_20120216** **Thema:** ERC-AG-PE4

**Title:** Imaging Magnetism in Nanostructures using Electron Holography

**Abstract:** Future developments in the control, functionalization and manipulation of magnetic nanoparticles and nanoscale magnetic devices require an understanding of collinear and non-collinear spin configurations and correlated changes of electronic structure on the sub-nanometer scale. In this project, an experimental methodology will be developed to allow magnetic spin structures in differently shaped nanomagnets to be visualized quantitatively and correlated with their crystallographic, compositional and defect structures. The project is based on the development of electron holography in the transmission electron microscope. It aims to provide quantitative measurements of

internal magnetic fields in nanoparticles and devices that have characteristic dimensions of between 2 and 20 nm with a spatial resolution of better than 1 nm, both in projection and in three dimensions. Developments in instrumentation will allow the measurements to be acquired in situ in the electron microscope at elevated and reduced specimen temperatures and in the presence of oxidizing and reducing gases. The project is highly interdisciplinary, requiring close collaboration between scientists working on nanoparticle synthesis, device fabrication, magnetic modeling, computational mathematics and characterization techniques. It will provide a powerful new analytical tool at the frontiers of the highest spatial resolution analysis of spin and electronic structures that will have far-reaching impact beyond a specific research domain, not only in fundamental magnetism but also for applications that include magnetic recording, spintronics, catalysis and biomedical applications of magnetic nanoparticles. The methodology will also benefit European industry by providing a new leading edge in the fast growing international market of in situ transmission electron microscopy.

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**NBR: 320917** **ACRONYM: INPEC** **EC FUND: 2133560**

**DG:** ERCEA **Call: ERC-2012-ADG_20120216** **Thema:** ERC-AG-PE2

**Title:** Interacting Photon Bose-Einstein Condensates in Variable Potentials

**Abstract:** Bose-Einstein condensation, the macroscopic ground state occupation of a system of bosonic particles below a critical temperature, has in the last two decades been observed in cold atomic gases and in solid-state physics quasiparticles. The perhaps most widely known example of a bosonic gas, photons in blackbody radiation, however exhibits no Bose-Einstein condensation, because the particle number is not conserved and at low temperatures the photons disappear in the system's walls instead of massively occupying the cavity ground mode. This is not the case in a small optical cavity, with a low-frequency cutoff imprinting a spectrum of photon energies restricted to well above the thermal energy. Using a microscopic cavity filled with dye solution at room temperature, my group has recently observed the first Bose-Einstein condensate of photons. Building upon this work, the grant applicant here proposes to study the physics of interacting photon Bose-Einstein condensates in variable potentials. We will study the flow of the light condensate around external perturbations, and exploit signatures for superfluidity of the two-dimensional photon gas. Moreover, the condensate will be loaded into variable potentials induced by optical index changes, forming a periodic array of nanocavities. We plan to investigate the Mott insulating regime, and study thermal equilibrium population of more complex entangled manybody states for the photon gas. Other than in an ultracold atomic gas system, loading and cooling can proceed throughout the lattice manipulation time in our system. We expect to be able to directly condense into a macroscopic occupation of highly entangled quantum states. This is an issue not achievable in present atomic physics Bose-Einstein condensation experiments. In the course of the project, quantum

manybody states, when constituting the system ground state, will be macroscopically populated in a thermal equilibrium process.

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**NBR: 320963** **ACRONYM: NEMESIS** **EC FUND: 2266020**

**DG:** ERCEA **Call: ERC-2012-ADG_20120216** **Thema:** ERC-AG-PE8

**Title:** Novel Energy Materials: Engineering Science and Integrated Systems (NEMESIS)

**Abstract:** The aim of NEMESIS is to establish a world leading research center in ferroelectric and piezoelectric materials for energy harvesting and energy generation. I will deliver cutting edge multi-disciplinary research encompassing materials, physics, chemistry and electrical engineering and develop ground breaking materials and structures for energy creation. The internationally leading research center will be dedicated to developing new and innovative solutions to generating and harvesting energy using novel materials at the macro- to nano-scale. Key challenges and novel technical approaches are: 1. To create energy harvesting nano-generators to convert vibrations into electrical energy in hostile environments (e.g. wireless sensors in near engine applications). 2. To enable broadband energy harvesting to generate electrical energy from ambient vibrations which generally exhibit multiple time-dependent frequencies. 3. To produce Curie-temperature tuned nano-structured pyroelectrics to optimise the electrical energy scavenged from temperature fluctuations. To further enhance the energy generation I aim to couple thermal expansion and pyroelectric effects to produce a new class of thermal energy harvesting materials and systems. 4. To create nano-structured ferroelectric and piezoelectric materials for novel water-splitting applications. Two approaches will be considered, the use of the internal electrical fields present in ferroelectrics to prevent recombination of photo-excited electron-hole pairs and the electric charge generated on mechanically stressed piezoelectric nano-rods which convert water to hydrogen and oxygen.

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**NBR: 321033** **ACRONYM: MOLS@MOLS** **EC FUND: 1998747**

**DG:** ERCEA **Call: ERC-2012-ADG_20120216** **Thema:** ERC-AG-PE3

**Title:** Controlling Molecular Spin at the Molecular Scale

**Abstract:** Because of their internal structure, molecules provide novel functionality not realizable in conventional semiconductor-based electronics. One exciting new possibility is that of spintronics: electronic devices using the electron spin to carry and manipulate information. So far, spintronics has been explored in metals and semiconductors. Magnetic molecules in principle enable radically new approaches in using the spin

degree of freedom, but their incorporation in solid-state devices is a daunting task. In particular, the main challenge is to control their spin for storing and reading information. We propose to use electric fields and light for this purpose. Based on our recent breakthroughs in making nanoscale junctions of noble metals and graphene, we will fabricate and study planar spin transistors built up from individual magnetic molecules or nanoparticles. A key device feature is that electrodes are separated by a distance on the scale of the molecular object itself. This geometry allows for in-situ application of strong local electric fields as well as optical fields to modify magnetic states and hence influence the conductance. The objective of this proposal is to study how the electric conductance through single molecules and nanoparticles can be used to probe their magnetic properties and how external stimuli can control them. We will perform proof-of-principle experiments divided into four challenging tasks: 1) Study of quantum aspects of transport through single magnetic molecules and nanoparticles; 2) Room-temperature studies of molecular magnetism on the molecular scale; 3) Measurement of spin-polarized currents through molecular-scale magnetic junctions; and 4) Control of molecular magnetism by local electric and optical fields. By obtaining a detailed understanding of the interplay between molecular magnetism and transport we strive to establish new strategies towards in-situ spin-state control and the development of novel spintronic nanodevices.

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**NBR: 321066** **ACRONYM: CATGOLD** **EC FUND: 2499060**

**DG:** ERCEA **Call: ERC-2012-ADG_20120216** **Thema:** ERC-AG-PE5

**Title:** ADVANCING GOLD CATALYSIS

**Abstract:** We plan to chase new goals by exploring the limits of gold chemistry and organic synthesis. A major goal is to promote copper to the level of gold as the catalyst of choice for the activation of alkynes under homogeneous conditions. Another major goal is to develop enantioselective reactions based on a new chiral catalyst design to overcome the inherent limitations of the linear coordination of d10 M(I) coinage metals. We whish to contribute to bridge the gap between homogeneous and heterogeneous gold catalysis discovering new reactions for C-C bond formation via cross-coupling and C-H activation. We will apply new methods based on Au catalysis to fill the gap that exists between chemical synthesis and physical methods such as graphite exfoliation or laser ablation for the synthesis of nanographenes and other large acenes.

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**NBR: 321268** **ACRONYM: IPLASMM** **EC FUND: 2257458**

**DG:** ERCEA **Call: ERC-2012-ADG_20120216** **Thema:** ERC-AG-PE7

**Title:** Frontiers in nanophotonics: integrated plasmonic metamaterials devices

**Abstract:** Photonic methamaterials have unique optical properties not available in natural materials. The key question is how to integrate metamaterials within nanophotonics circuitry to harness all the advantages they offer in controlling light on the nanoscale. iPLANET will develop a plasmonic nanorod metamaterial platform for applications covering the entire spectral range from mid-IR through telecom to visible and UV, be CMOS compatible and monolithically integratable in photonic circuitry. Using the unique optical properties of nanorod-based metamaterials, a very high density of photonic states can be achieved, essential for controlling light emission, scattering and nonlinearity in the nanophotonic environment. The project will challenge the frontiers of nanophotonics through the use of these specific to metamaterial properties to achieve integrated nonlinear photonic components with reduced size and energy consumption and integrated bio- and chemical sensors with increased sensitivity, multi-parameter sensing in a broad spectral range, all on the same metamaterial platform. This will be a transformative development for the applications of nanophotonics in optical information processing in integrated photonic circuits and for the realization of integrated sensors for point-of-care devices, security and environmental monitoring. The success of the project will unlock the potential of metamaterials for the improvement of the real-world photonic devices and provide insight into physical phenomena which are vital for various areas of optical physics and sensing. This will probably be the first demonstration of commercially-viable application of metamaterials. It will transform the areas of both nanophotonics and metamaterials and consolidate and enhance the European leadership in this field.

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**NBR: 321295** **ACRONYM: EPCABO** **EC FUND: 1889200**

**DG:** ERCEA **Call: ERC-2012-ADG_20120216** **Thema:** ERC-AG-PE5

**Title:** Engineered Protein Capsids as Artificial Bacterial Organelles

**Abstract:** Many proteins self-assemble into regular, shell-like, polyhedral structures. Protein capsids are useful, both in nature and in the laboratory, as molecular containers for diverse cargo molecules, including proteins, nucleic acids, metal nanoparticles, quantum dots, and low molecular weight drugs. They can consequently serve as delivery vehicles, bioimaging agents, reaction vessels, and templates for the controlled synthesis of novel materials. Here, we will apply our experience with protein design and laboratory evolution to extend the properties of protein containers to create practical, non-viral encapsulation systems for applications in the test tube and in living cells. Specifically, we will adapt the icosohedral cage structures formed by Aquifex aeolicus lumazine synthase (AaLS) to engineer increasingly sophisticated supramolecular complexes for use as delivery vehicles, nanoreactors and, ultimately, as bacterial organelles. Our principal aims are to: (a) tailor AaLS capsids for selective encapsulation of a broad range of

macromolecular guests; (b) develop AaLS capsids as delivery vehicles for medical and imaging applications; (c) design simplified, functional mimics of carbon-fixing carboxysomes; (d) evolve redox active organelles for metabolizing aliphatic alcohols; and (e) engineer artificial organelles for the detoxification of polychlorinated phenols. We anticipate that these experiments will lead to a deeper understanding of the principles underlying the construction, function and evolution of natural protein microcompartments. At the same time, they will establish powerful strategies for creating tailored assemblies for practical applications in delivery and catalysis.

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**NBR: 321331** **ACRONYM: COMPLEXPLAS** **EC FUND: 2000000**

**DG:** ERCEA **Call: ERC-2012-ADG_20120216** **Thema:** ERC-AG-PE3

**Title:** Complex Plasmonics at the Ultimate Limit: Single Particle and Single Molecule Level

**Abstract:** Nano-optical investigations using plasmonic resonances have revolutionized optics in the last few years. The ability to concentrate light in subwavelength dimensions and to locally enhance the strength of the electromagnetic field in a tailored fashion opened several new fields in materials research, such as tailoring the linear and nonlinear properties of optical materials at will. So-called metamaterials allow now to design and realize unprecedented optical properties on the submicrometer level and hence tailor dispersion as well as real and imaginary parts of the linear and nonlinear refractive indices as a function of wavelength and wavevector. Our ability to create two- and three-dimensional nanostructures with advanced fabrication technologies have led to the new era of complex plasmonics. We are able to tailor the spectral response of complex metallic nanostructures, including the creation of very sharp and narrow resonances. In combination with strong field localization and hence large dependence on the material properties of the nanostructure geometry and its surrounding, unique sensors with sensitivities close to fundamental limits should be within reach. In my proposal, I would like to explore the ultimate limits of light-matter interaction using complex plasmonic nanostructures. I would like to apply them to different physical, chemical, and biological situations and undertake the first steps from fundamental insight into first applications. Namely, I would like to investigate complex plasmonics in four different contexts: single molecule reactions on complex surfaces, antenna-enhanced structural analysis of large single molecules, such as proteins, motion sensing of conformational changes of single molecules, as well as chiral sensing down to the single molecule level, hence ultimately being able to distinguish a single D-glucose molecule from its L-glucose enantiomer. This would bridge the gap between nanophysics, chemistry, and biology.

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**NBR: 321339** **ACRONYM: ECOF** **EC FUND: 2431728**

**DG:** ERCEA **Call: ERC-2012-ADG_20120216** **Thema:** ERC-AG-PE5

**Title:** Electroactive Donor-Acceptor Covalent Organic Frameworks

**Abstract:** The effective conversion of light into chemical or electrical energy is one of the major challenges of humanity during the 21st century. Organic bulk heterojunctions of polymers or aggregates of small molecules combining donor- and acceptor-functionality offer promising prospects for effective light-induced energy conversion. In order to efficiently utilize the solar energy, interpenetrating networks of donor- and acceptor components are often required. While impressive advances have been achieved in organic photovoltaics systems, so far a deterministic control of their nanoscale morphology has been elusive. It would be a major breakthrough to develop model systems with well-defined periodic, interpenetrating networks of electron donor- and acceptor-phases. It is the goal of this project to create such highly defined model systems, to enhance our understanding of the relationship between the electronic and structural parameters and the resulting light-induced charge carrier dynamics. To pursue this challenge, we base our strategy on the recently discovered conceptual paradigm of Covalent Organic Frameworks (COFs). COFs are a class of highly porous, organic crystalline materials that are held together by covalent bonds between molecular building blocks. In a concerted team effort with organic chemists, we will create COFs with different π-stacked heteroaromatic electron donor- and acceptor moieties, thus forming highly ordered interpenetrating networks for light-induced charge separation. This interdisciplinary program is unique as we join the forces of top-level organic synthesis with advanced nanoscience and in-depth physical characterization in one team.

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**NBR: 321570** **ACRONYM: EURONANOMED II** **EC FUND: 1499990**

**DG:** RTD **Call: FP7-ERANET-2012-RTD** **Thema:** NMP.2012.1.2-3

**Title:** EUROpean network for transnational collaborative RTD projects in the field of NANOMEDicine

**Abstract:** Nanomedicine, the application of nanotechnology to health, is a fast-growing field with a large potential for improving diagnostics and therapeutic solutions in many diseases. The EuroNanoMed II (ENM II) consortium, with 20 partners from 17 countries and regions, aims to foster the competitiveness of European nanomedicine actors through the support of translational research projects enhancing transnational and multidisciplinary collaborations between academia, clinical/public health communities and industry. ENM II will be a follow-up of the ERA-NET EuroNanoMed I (ENM I), which launched three joint transnational calls for proposals in three years. The increasing number of submitted proposals in the successive ENM I joint calls and their quality show

the need amongst the nanomedicine scientific community for such a targeted initiative. ENM II will be built on the basis of the ENM I accomplishments, and will continue to support transnational innovative RTD projects in nanomedicine through the launch of yearly joint calls for proposals. In addition, ENM II aims to extend the cooperation among its partners through the development of other activities: (i) foster the participation of young European researchers to ENM II activities; ii) develop a strategic agenda for ENM II in close cooperation to the ETP Nanomedicine; iii) create more interactions within the European nanomedicine community and improve communication on nanomedicine to the public; iv) frame and address regulatory, safety and ethical issues associated with nanomedicine; v) monitor the results of the ENM I & ENM II funded research projects and the activities of the ENM II network; and, vi) develop a long-term cooperation framework for European nanomedicine research. Therefore, through joint funding of translational nanomedicine projects and its other activities, ENM II will contribute to enhance coordination of research and resources in this field, thereby shaping the European Research Area in nanomedicine.

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**NBR: 321639** **ACRONYM: MULOPLA** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2012-CIG** **Thema:** FP7-PEOPLE-2012-CIG

**Title:** Multistage Logic Platforms

**Abstract:** Microfluidic technologies offer significant advantages in crystal growth design and guided assembly when compared to conventional synthetic methods. For this reason, the motivation of the present project will be leaded to construct microfluidic platforms, hereafter called Multistage Logic Platforms (MuLoPla), where site-specific crystal growth, different patterns, and multiple template assemblies can be feasible in a single chip and on a surface. Among others, charge transfer complexes, charge transfer salts, and metal-organic frameworks will be the scope of the present project due to their broad interest in areas comprehending chemistry, nanotechnology, materials science, and physics communities. Furthermore, a premise of the proposed project will not just be a localized crystallization of functional materials, but their integration to read out components (i.e. electrodes) will be envisioned in a single MuLoPla.

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**NBR: 321642** **ACRONYM: PLATFORM2NANO** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2012-CIG** **Thema:** FP7-PEOPLE-2012-CIG

**Title:** Development of a microfluidic platform to produce nanomaterials and assessment on new nanotechnology applications

**Abstract:** Chemically synthesized nanomaterials (NMts) are being considered as the active elements in many applications, including, photonics, catalysis, energy, medical diagnosis and treatments. In order to achieve the promise of these applications, it will be critical to have an efficient, reproducible synthesis technique to produce the NMts. Currently, nanoparticles are synthesized in a batch mode in small volumes, which is suffering from irreproducibility and lack of NMts quality from batch to batch. Furthermore there are challenges in scaling batch procedures up to quantities needed for application development. Consequently, a new technological approach is required to assure nanotechnology feasibility. This project takes as a goal the development of multi-functional platforms based on microfluidics (MF) to address the wet-chemistry weaknesses and restrictions of small-scale batch reactors. Basically, MF allow an exquisite control on synthesis variables. The superior reaction control in a microliter or even nanoliter volume, enable to nanoengineer NMts in a continuous production process, addressing some issues such as scaling up and reproducibility. Additionally, MF promote some valuable advantages, including enhancement of mass and heat transfer, feedback control of temperature and feed streams, safer operational environment and potential for sensor integration. A variety of MF approaches will be developed to fine tune the NMts: sequential addition, slug flow, microwave and ultrasound irradiation. Since the applicant is a member of the highly-interdisciplinary Aragon Institute of Nanoscience, several collaborations with researchers from other areas have already been established. This enables the NMts obtained from this emerging technology to be employed in applications related not only to catalysis, which is the applicant´s main field of activity, but also in other areas such as nanocomposites and nanomedicine, where nanoparticles play a key role.

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**NBR: 321675** **ACRONYM: GENETIC NANOPROBES** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2012-CIG** **Thema:** FP7-PEOPLE-2012-CIG

**Title:** GENETICALLY ENCODED FLUORESCENT NANOPROBES FOR DETECTION OF RNA INTERACTIONS

**Abstract:** Achieving a quantitative understanding of the transcriptome is critical to the development of RNA biology and RNA-based therapeutics. One of the main “road-blocks” to the advancement of these fields is the inability, at present, to dynamically track most RNA molecules in vivo. In order to achieve a quantitative understanding of RNA interactions in vivo, we propose to develop a new class of genetically encoded fluorescent probes that will be designed to dynamically track gene expression (mRNA), miRNA trans-interactions, riboswitch or hairpin-type cis-interactions, ribozyme, and any other class of ncRNA. The probes will consist of large self-assembled RNA-FP complexes that will report RNA-RNA interaction dynamically via an engineered structural change that will be detected through a change in fluorescence. The signal will consist of a change in the light polarization, and will be detected by a novel implementation of a

polarization Total Internal Reflection Fluorescence (polTIRF) microscope design, which will enable the detection of small structural changes within the nanoprobe at fast sampling rates. In this proposal, I intend to develop, in bacteria, the first generation of these probes. Development of the probes and the imaging apparatus will take place simultaneously, in order to optimize both detection capability and the probe design. The development and demonstration of the probes' capabilities will be guided by three objectives, each divided into individual milestones and sub-projects. In particular, I intend to use this approach to quantitatively characterize synthetic hammerhead ribozyme trans interaction, cis-acting RNA thermosensors, and the Hfq RNA-protein complex. I believe that successful implementation of this combined molecular and imaging tool to quantitatively characterize the kinetics associated with RNA-RNA trans/cis-interactions will constitute a proof-of-principle to the broad applicability for our method to other RNA-based platforms.

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**NBR: 321692** **ACRONYM: SMONDEP** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2012-CIG** **Thema:** FP7-PEOPLE-2012-CIG

**Title:** Scalable Manufacturing of Organic Nano Devices for Electronics and Photonics

**Abstract:** This research activity aims to demonstrate an economically viable and scalable nano-manufacturing method using a modified Chemical Vapor Deposition technique and a nano pattern transfer method based on silicon nanomembrane technology for the fabrication of nanostructured polymeric device components for electronics and photonics. The multidisciplinary nature of the proposed research will fuse science and engineering to overcome technological roadblocks for heterogeneous integration of polymeric materials into conventional micro- and nano-fabrication processes. The economically viable and scalable nano-manufacturing methods will enable the use of polymeric materials in conventional & future device designs opening new opportunities for electronic and photonic applications. The research will also address the need for novel polymeric materials with better chemical and thermal stabilities, and scalable processes that can take advantage of these chemistries to fabricate electronic/photonic devices reliably at low temperatures and at a reduced cost. The proposed method of integration of polymeric nanostructures into conventional nano-fabrication processes is scalable to a wafer size process and can also be optimized for roll-to-roll processing. The proposed work will advance the use of polymeric materials in semiconductor manufacturing in a real and significant way.

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**NBR: 321716** **ACRONYM: CIGACP** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2012-CIG** **Thema:** FP7-PEOPLE-2012-CIG

**Title:** A New Halo-Imidazolums and Halo-Triazoliums Halogen-Bonding Receptors for Anion Recognition and Sensing

**Abstract:** With a view to increasing the understanding of molecular recognition processes in biological systems and producing new molecular sensors, switches and devices, my research is focused on the synthesis of novel host molecules that contain redox- or photo-active reporter groups. These systems have been designed to complex and sense, anionic or neutral inorganic or organic guest species via electrochemical and optical methods. Selective binding of a particular guest species is of paramount importance for commercial applications such as potential prototypes of new molecular sensory devices, molecular switches and extraction agents for cleansing the environment of toxic materials. Recently I have been exploring the use of the halogen bonding in solution as a receptor of anions. Halogen bonding is largely underexploited, with the majority of reported cases in the solid state. However, I have recently reported the first example of a receptor for anions in aqueous media through halogen bonding. Integrating halogen atoms into molecular host frameworks influences greatly the host's recognition behaviour. Especially interesting is the area of surface and nanoparticle chemistry, due to the singular optical and electrochemical properties of nanoparticles and their applications in catalysis, biomedical imaging and materials. My research in this area focuses on exploiting the remarkable surface enhancement of anion recognition to fabricate highly sensitive and selective anion detection devices.

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**NBR: 321726** **ACRONYM: CRITICALFORCE** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2012-CIG** **Thema:** FP7-PEOPLE-2012-CIG

**Title:** Applications of Critical Casimir Forces

**Abstract:** Nanoscience and nanotechnology are in the process of revolutionising the way we live and do science. In the context of this drive towards the nanoscale, the specific aim of the present project to provide new tools to harness forces and interactions at mesoscopic and nanoscopic length-scales, e.g., the forces arising between several nanodevices, by gaining a better understanding and by exploring possible applications of critical Casimir forces. Critical Casimir forces are interesting from the fundamental point of view as a manifestation of critical phenomena, but also, and perhaps more importantly, from the technological point of view, e.g., as a tunable mechanism to prevent the sticking in MEMS and NEMS (micro- and nanoelectromechanical systems) due to QED (quantum-electrodynamical) Casimir forces. The experimental study of critical Casimir forces acting on microscopic object is a fairly new field of research, which can benefit from the novel techniques we are going to deploy within this proposal.

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**NBR: 321739** **ACRONYM: SAMSFERE** **EC FUND: 75000**

**DG:** REA **Call: FP7-PEOPLE-2012-CIG** **Thema:** FP7-PEOPLE-2012-CIG

**Title:** Self-Assembled Monolayers over Ferromagnetic Electrodes for Organic Spintronics

**Abstract:** Organic materials offer unique properties like: i) processablility and plastic technology compatibility, ii) monodispersity and tunability and iii) long time spin coherence that make them appealing for spintronics devices and hence, a great number of proposals exits about its use in spintronics applications. Nevertheless, organic spintronics is in its infancy and so far only a small number of different organic materials have been used in spintronic research to realize an even smaller number of this proposals. First reports on the integration of organic materials into spintronic devices date back to 2002. Self-assembled monolayers with their special characteristics are an invaluable tool set for the developing and understanding of spin transport. As tunnel barriers SAMs i) Can be easily engineered: Are modular and their parts can be exchanged while keeping the others unchanged, ii) Are intrinsically nanometre thick: Film thickness will be determined by molecule size and SAM structure, iii) Have defined structures: SAM formation is a self-assembly process, structure is preprogramed and iv) Are promising to candidates to work at high-bias. SAMSFERE aims to expand the current know-how in the field of organic spintronics and lay the base of a solid understanding of the spin-transport through interfaces by the growing of a completely new set of SAMs over FM electrodes that will be employed in the development of devices based on magnetoresistive effects(organic magnetic tunnel juntions) and beyond (spin organic light-emmiting diodes).

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**NBR: 321742** **ACRONYM: DW_FDTP_UVA** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2012-CIG** **Thema:** FP7-PEOPLE-2012-CIG

**Title:** Understanding functional drivers in two terrestrial key processes- nitrogen fixation and cellulose degradation- by a single cell approach

**Abstract:** The terrestrial C and N cycles are essential for the Earth's biosphere and intimately linked by microbial activity. Understanding the participants and drivers rendering biologically available N is imperative as N is a limiting factor for primary production. Soils contain the largest pool of C on Earth with cellulose being a major constituent of this C. Therefore understanding this process is essential since it can either promote C sequestration or be a source of atmospheric CO2. My NanoSIMS group in the Department of Microbial Ecology at the University of Vienna focuses on the investigation of two microbial key processes; plant polymeric carbon degradation and nitrogen fixation. Our goal is to understand the active drivers of these processes and

their in situ contributions, the degree of efficiency and regulation mechanisms using a multidisciplinary approach combining methods of biogeochemistry, molecular biology, ecology, soil science, and bacterial physiology. It is timely to now apply a functional approach to study the aforementioned processes due to the recent advance in single cell approaches. To identify the active participants of the two processes, we propose to combine stable isotope probing experiments (15N2 gas or 13C-cellulose) with cell identification with FISH/HISH, Raman microspectroscopy and NanoSIMS. These single cell techniques allow comparing the in situ activities of different microbial groups and the analysis of within population heterogeneity. We aim to differentiate the contributions of cellulose-degrading fungi and bacteria, as well as targeted groups within the bacteria. Second, we aim to better characterize participants in soil N2 fixation with particular emphasize on novel groups who are believed to be highly active. The synthesis of stable isotope probing experiments with single cell genomics will allow us to identify novel microorganisms of the targeted function and describe their ecophysiology in the soil.

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**NBR: 321755** **ACRONYM: TRANSEXMAT** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2012-CIG** **Thema:** FP7-PEOPLE-2012-CIG

**Title:** Transient Analysis of Exotic Materials for Electromagnetics

**Abstract:** Simulating the interaction of electromagnetic interaction plays a centrol role in the design of new, exotic materials for use in electronic, photonic, and optical systems. In order to design these systems subject to all technical and economic constraints, broad band information on their behaviour is indispensable. Moreover, modern exotic materials and the devices in which they are used can exhibit nonlinear behaviour. This leaves transient (i.e. time domain) simulation the only viable option. The aim of this project is the development of a design methodology and the corresponding software tools for the exotic electromagnetic materials for use in photonics, transformation optics, biomedical imaging, and nano-technology. This project is innovative because it will enable for the first time (i) the design of nonlinear exotic electromagnetic materials, (ii) the design of devices comprising both regions containing uniform and regions containing non-uniform exotic materials, (iii) the design of exotic materials of size and complexity as encountered in practical situations, and (iv) the deployment during the design process of computing infrastructure that is heterogenous and unreliable, allowing the use of more affordable hardware and leading to true scalability.

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**NBR: 321769** **ACRONYM: SNCB** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2012-CIG** **Thema:** FP7-PEOPLE-2012-CIG

**Title:** Smart Nanoplasmonics for Chemistry and Biology

**Abstract:** This multidisciplinary proposal will utilize smart plasmonic concepts to solve intriguing biological and chemical problems. The plasmonic nanostructures will be arranged using biochemical linkers to provide sharp multipolar resonances which are highly sensitive to structural changes in space. The resulting plasmon rulers enable high-resolution plasmon spectroscopy and render possible optical detection of cellular activities and 3D dynamic behavior of bioentities. These smart plasmonic nanostructures will help to answer many profound questions in biochemistry that have eluded definite conclusions. These innovative concepts will pave the way towards a whole new era in research by bridging prosperous disciplines, plasmonics, physics, biology, and chemistry.

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**NBR: 321791** **ACRONYM: UCNANOMAT4IPACT** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2012-CIG** **Thema:** FP7-PEOPLE-2012-CIG

**Title:** Novel Upconversion Nanomaterials for Inorganic Photoactivated Chemotherapy

**Abstract:** Upconversion nanoparticles (UCNPs) have outstanding optical and magnetic properties, which make them extremely suited for application in cancer phototherapy and imaging. They efficiently convert low energy near infrared (NIR) light to higher energies in the visible. The so-generated upconverted luminescence can be exploited to photoactive anticancer metal complexes, a promising class of compounds studied as novel photochemotherapy agents. UCNP-mediated NIR activation will allow overcoming metal complexes' light absorption limitations, simultaneously achieving considerably higher tissue penetration and preserving photochemical reactivity. Indeed, the rich photochemistry of metal complexes can result in unique cell killing modes, critically important in the development of novel anticancer prodrugs. The project aims at investigating the use of UCNPs in the photoactivation of promising anticancer metal complexes, and more specifically at developing new nanomaterials where these two components are integrated to give a superior prodrug. Anchoring photoactive anticancer coordination compounds on UCNPs can produce materials with optimal photophysical and photochemical properties for chemotherapy. Moreover, the chemical versatility of UCNPs offers opportunity for functionalization with biological vectors, which improve biocompatibility, targeting and selectivity features of these integrated nanomaterials in cells and tissues. Remarkably, UCNPs are also excellent new candidates for multimodal (optical/MRI/PET) bioimaging. Their upconverted luminescence, magnetic resonance relaxivity and radioactivity (ease of 18F-labeling) will serve to visualize fundamental biological events with high spatial resolution, which are key to study the photoactive nanomaterials' anticancer action as well as for their medical use.

All such features combined together have the potential to deliver innovative therapeutic and imaging agents for cancer phototherapy.

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**NBR: 321821** **ACRONYM: ACTIVE NANOPORES** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2012-CIG** **Thema:** FP7-PEOPLE-2012-CIG

**Title:** Active Polymer-Functionalized Nanopores

**Abstract:** The project aims to develop, characterize and utilize nanopores functionalized with polymers. A new type of "active" nanopores with incorporated metal film electrodes will be fabricated. In contrast to existing nanopores, this enables electrochemical control and plasmonic readout of the contents inside the pore. Parallel to fabrication and characterization of active nanopores, the project will investigate the behaviour of stimuli responsive polymers using electrochemical plasmonic sensors. Such polymers undergo conformational changes (phase transitions) in response to changes in the local environment (e.g. pH or temperature). The phase transitions can be induced by electrochemistry. By functionalizing the active nanopores with responsive polymers, the permeability of the pores can be controlled by simple electrical signals. This is because local changes in the chemical environment, induced by electrochemical potentials, can induce phase changes in the polymers. This leads to new applications such as tunable permeability and electrically controlled gating. The excitation of surface plasmons in the metal films offers the possibility to monitor nanopore functionalization and also to detect conformational changes in the polymers. It is explained how the CIG grant will strongly help the applicant to estblish independent, original and high quality research activities at the host. The applicant is currently starting his evaluation period of four years at the host. The grant will strongly improve the chances for the applicant to be integrated at the host and start a successful long lasting career.

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**NBR: 321836** **ACRONYM: NANO4BIO** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2012-CIG** **Thema:** FP7-PEOPLE-2012-CIG

**Title:** Detection of Biomarkers using Nanorods and Nanopore technologies

**Abstract:** The application for the FP7-PEOPLE-2012-CIG is to support a move and integration of a new academic moving to Loughborough University, UK to take up a position of Lecturer in Analytical Chemistry. The researcher to date has published 21 peer reviewed journals and has a current h-index of 9. The funding is to secure and facilitate the long term integration of the researcher building upon his years of research experience and his existing independent research which has already produced patent applications and

publications. In moving to Loughborough the applicant will be positioned within a world renowned department active in the field of analytical chemistry and biomarkers detection. This research proposal outlines a new technique capable of screening biomarkers with the capability of working directly in biological samples. The benefits of monitoring biomarkers lie in their ability to reveal signs of disease before the onset of major symptoms. The proposed technique will involve synthesizing nanoparticles that will be functionalized with aptamers/ or antibodies. These functionalized particles will capture the biomarkers directly from solution resulting in particle aggregation, and in conjunction with a resistive pulse sensing technology, will allow the quick separation and detection of the analyte, creating a new diagnostic technology. The experimental details will deliver a single process capable of capturing the analyte as well as performing the initial sample purification and pre-concentration stage that screens multiple biomarkers for several diseases across a wide range of molecular weights and functionalities When combined with the support infrastructure in place at Loughborough, the award will deliver a world leading research group integrated into the EU, delivering a new diagnostic technique to enhance the European research portfolio.

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**NBR: 321838** **ACRONYM: EEEF-GBE-CNS** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2012-CIG** **Thema:** FP7-PEOPLE-2012-CIG

**Title:** Effect of an External Electric Field on Grain Boundary Evolution in the Course of Nano-Ceramic Sintering

**Abstract:** Consolidation of oxide nanoparticles in the presence of an electric field has provided promising results for retaining the nanostructure in the bulk. Although the sintering of nanoparticles shares the same basic principles as those for the sintering of coarser particles, a number of issues and challenges are specific to nanosintering. From a thermodynamic point of view, solid state sintering can be described as a thermally activated process during which the total interfacial free energy of an assembly of particles of equilibrium chemical composition decreases. Moreover, the consolidation and the grain growth pattern are determined by the ratio of the solid-vapour interfacial energy to the solid-solid interfacial (i.e., grain boundary) energy of the material. We propose to take a first step towards elucidating these processes in the presence of an external electric field by testing the synergistic effects of an external electric field and dopants on the grain boundary energy and sintering mechanism of oxide nanoceramics. Our first objective is to study the individual contribution of the dopant on the surface and interfacial energies. We hypothesize that the dopant will significantly affect these energies and thereby change the sintering course. Our second objective is to study the effect of a DC electric field on the dopants, the interfacial and surface energies, the space charge layer, and the grain size of the materials. We will map the contribution of each parameter to the consolidation process. The most promising parameter will be further investigated by studying the properties of the resulting material which is the

third objective of this study. The experiments proposed here will increase our understanding of the consolidation mechanism of nanoceramics in the presence of an external electric field.

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**NBR: 321879** **ACRONYM: FLUOSYNES** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2012-CIG** **Thema:** FP7-PEOPLE-2012-CIG

**Title:** New nanosized metal oxy-FLUOrides: tailored SYNthesis and Energy Storage

**Abstract:** Metal fluorides display numerous fields of applications which have been boosted by the emergence of fluorine nanochemistry. This proposal aims to develop new synthesis method to prepare nanosized metal fluorides with an emphasize on the understanding of the crystal formation. This will allow a fine control of the chemical composition/structure as well as the morphology of the prepared solid which is to be used in electrochemical devices, notably Li- and Na-ion batteries. Furthermore, a mechanistic investigation of Li and Na storage capacity in such materials will be conducted through advanced physico-chemical characterizations tools (synchrotron, NMR, etc). Finally, in marge of fundamental studies, the final aim of this work is also to propose a battery prototype and to provide a scalable method to prepare new class of fluorinated materials for next generation of electrode materials having high energy density.

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**NBR: 321951** **ACRONYM: ECOFIRE-NANO** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2012-CIG** **Thema:** FP7-PEOPLE-2012-CIG

**Title:** New generation of eco-benign multifunctional layered double hydroxide (LDH)-based fire retardant and nanocomposites

**Abstract:** Polymeric material products are ubiquitous in various fields in day-to-day life, while a key limitation is most of polymeric materials are flammable. Aim to improve the fire retardancy of polymeric materials, circumvent the drawback of traditional fire retardants (FRs), create novel functionality, in this project, new generation sustainable environment-friendly multifunctional FR and high performance polymer nanocomposites are developed via combination of innovative molecular design, sophisticated chemical synthesis and advanced processing. Layered double hydroxide (LDH), low-cost sustainable environment-friendly nanofiller with good fire retardance, is chosen as the main candidate for offering the fire retardant framework. The multifunctional biobased modifier, β-cyclodextrin(CD)-based (char agent), with high fire retardance, excellent anti-UV property (via combined with chalcone extracted from

plant) functional group and strong ionic-exchange capability are designed, synthesized, characterized and used to modify LDH in order to develop multifunctional LDH with excellent fire retardance and anti-UV property. Phytic acid sodium salt derived from plants will be used as co-modifier for LDH in order to provide biobased phosphorus storage (acid source). This combination will form nanoscale biobased intumescent fire retardants in the interlayer of LDH, leading to the fire retardant efficiency is improved significantly compared with traditional organic surfactant (being flammable) modified LDH. To evaluate fire retardant efficiency, anti-UV property and other properties, two typical polymers, epoxy resin and PP, are chosen as polymer models. As novel sustainable multifunctional nanoscale fire retardant, it integrates the present advantages from inorganic-FR, intumescent-FR, nano-FR and reactive-FR in the state-of-the-art and possesses new properties, owning the feathers of sustainability, environmental friendliness, high efficiency, smoke suppression and multifunction.

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**NBR: 321952** **ACRONYM: HYNANO** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2012-CIG** **Thema:** FP7-PEOPLE-2012-CIG

**Title:** Hybrid Nanophotonics for Enhanced Light Control

**Abstract:** Coupling of quantum emitters, and the exploitation of multi-photon quantum interference, is the next challenge for generation optical information technology and quantum computation. The aim of this proposal is to achieve long-range coupling of two or more quantum emitters, understanding the fundamental mechanisms of light transport, nano-optical emission control and resulting collective phenomena, such as super-radiance and lasing. A model system will be realised where the light originated from one quantum emitter is transported to the next one by a combination of photonic crystal waveguide and optical nano-antennas which together act as a bridge for light transport from the micrometer to nanometer scale.

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**NBR: 321993** **ACRONYM: PALM TCR COMPLEXES** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2012-CIG** **Thema:** FP7-PEOPLE-2012-CIG

**Title:** Studying the Structure and Dynamics of TCR nucleated Complexes at the single molecule level

**Abstract:** The cell transduces information across its plasma- membrane via the engagement of surface receptors and the subsequent recruitment of intracellular proteins to these receptors or to adapter proteins to form transient and heterogeneous signaling complexes. Multi- molecular signaling complexes can, in turn, be found in large

microclusters or aggregates. Such signaling complexes and clusters have been shown to play a crucial role in T cell activation and thus, in the ability of the immune system to adequately respond to foreign pathogens. However, little is known about the detailed structure, content, and organization of signaling complexes due to severe limitations of current experimental techniques. I propose to develop and apply cutting-edge super-resolution microscopy techniques, biophysical models, and statistical methods to study mechanisms of cell activation by signaling complexes in single-molecule detail in intact cells. Previously, by imaging complexes downstream of the T cell receptor at the single-molecule level with photoactivated localization microscopy (PALM), I found that these complexes show functionally significant nano-scale organization at the plasma-membrane of activated cells. I hypothesize that signaling complexes have additional levels of dynamic organization that are crucial to the plurality of functions of these complexes in adequately activating T cells. Importantly, my developed techniques and expected results will be relevant to many other signaling systems and will greatly extend our understanding of the composition, structure, and formation of signaling complexes and mechanisms of cell activation in health and disease. Such knowledge will present novel opportunities for pharmacological intervention in diseases involving inadequate immune responses and in cancer.

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**NBR: 322073** **ACRONYM: NPINMUPSS** **EC FUND: 75000**

**DG:** REA **Call: FP7-PEOPLE-2012-CIG** **Thema:** FP7-PEOPLE-2012-CIG

**Title:** Separation of Nanoparticles (NP) in Multiphase Systems (MuPSs)

**Abstract:** In biological systems, functions involving molecular recognition are crucial since key interactions in the body, such as protein-ligand and protein-protein interactions, depend on molecular binding events (e.g., hydrogen-bonding, π -stacking, and electrostatic interactions). Nanoparticles with molecular recognition properties found promising applications in biotechnology due to the advantages that the nanoscale offers, such as clear optical signatures and a high surface area-to-volume ratio. Nanoparticles exhibit size, shape, chemistry-dependent properties. Current nanoparticle synthesis methods produce heterogeneous populations. There is a need for a cost-effective and easy-to-use method which can enrich the populations of nanoparticles based on size, shape and chemistry. In this proposal, we will present such a toolbox to enable this kind of separations, use the enriched populations of nanoparticles in technological and scientific applications, and carry out nanotoxicology studies correlating the response of living systems to the exposure of homogeneous nanoparticles.

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**NBR: 322084** **ACRONYM: NANOFAB4CNT** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2012-CIG** **Thema:** FP7-PEOPLE-2012-CIG

**Title:** Novel bottom-up nanofabrication techniques for future carbon-nanoelectronics

**Abstract:** This research program aims at pioneering and developing new nanofabrication techniques for carbon-nanoelectronics using a so-called 'bottom-up' approach. Individual building blocks for carbon-based nanodevices, such as catalyst nanoparticles, horizontally aligned carbon-nanotubes and ultra-scaled contacts and dielectrics will be precisely placed directly on the chip, without the use of lithography. This will be accomplished by using unique combinations of electron-beam induced deposition (EBID), atomic layer deposition (ALD) and oblique ion beam treatments. The process development will go hand-in-hand with atomic level understanding of the developed processes using in-situ and ex-situ analysis techniques to ensure process reproducibility and selectivity. The need for new nanofabrication processes is a consequence of continuous down-scaling of electronic devices over the last 60 years for improved device performance. This continuous down-scalling will soon come to an end due to material limitations and the absence of viable processing techniques for even smaller nano-devices. On the materials side, carbon nanotubes (CNTs) and graphene hold great promise for next-generation nano-electronics due to their superior materials properties. However, for successful introduction of such carbon-based nano-devices in commercial products many manufacturing challenges need to be solved. Current 'top-down' electronics manufacturing techniques (e.g., materials patterning using photo- or e-beam lithography) will not be able to overcome these challenges. At the end of this research program a toolbox will be available with direct-write nanofabrication techniques that are universally applicable in any bottom-up nano-device manufacturing process. This toolbox will aid further scaling and improvement of future nano-electronic devices.

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**NBR: 322104** **ACRONYM: ECOPOD** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2012-CIG** **Thema:** FP7-PEOPLE-2012-CIG

**Title:** Environmentally Controlled Polymorphism of non-B DNA structures

**Abstract:** Repetitive blocks of guanine- and cytosine-rich sequences, such as those occurring in centromeric and telomeric DNA regions and promoter regions of protein coding genes, have ability to form G- and C-quadruplex structures, respectively. These non-B DNA structures are involved in more than 40 pathological human conditions including cancer. From a biophysical point of view, a common property to both G- and C-rich sequences is their inherent sensitivity to non-specific, physical-chemical environmental factors promoting their conformational polymorphism. Despite significant effort, motivated by both biological significance and biotechnological and biomedical applications of these non-B DNA motifs, the mechanistic nature of the environmentally induced effects remains poorly understood. The mechanistic insight and revealing of relationships

between the DNA sequence and its folding topology in relation to its environment is essential for both rational design of novel nanomaterials and ways for their manipulations as well as for related biomedical applications. In this project, we propose systematic investigations of the influence of non-specific physical-chemical factors on structure of the DNA quadruplexes. In parallel, we propose characterization of these structures under the physiological conditions in vivo using state-of-the-art method of in-cell NMR spectroscopy. The acquired information will help to identify physiologically relevant structures of G- and C-quadruplexes.

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**NBR: 322111** **ACRONYM: ATOMNANO** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2012-CIG** **Thema:** FP7-PEOPLE-2012-CIG

**Title:** QUANTUM INTERFACE BETWEEN ATOMIC AND NANO-PHOTONIC SYSTEMS

**Abstract:** Techniques to interface atomic systems with quantum optical fields form a cornerstone for future technologies that aim to exploit the laws of quantum physics for enhanced performance over classical devices. For example, quantum information processing is perhaps at the forefront of such possibilities, where photons can be used to relay information over large distances, while atoms naturally are physical systems that can process and store this information. The vast majority of atom-light interfaces developed thus far have been in relatively bulky geometries, such as atomic ensembles in free space or atoms coupled to macroscopic Fabry-Perot cavities. While remarkable progress has been made, these systems remain difficult to scale up and have limited functionality compared to the potential of atomic systems coupled with state-of-the-art nano-photonic devices. ATOMNANO will be a broad theoretical effort aimed at investigating novel techniques to trap cold atoms near nano-photonic structures, developing promising applications for these systems, and advancing theoretical tools to understand the emerging physics. The constituent projects will interface compelling ideas at the interface of several fields such as quantum optics, atomic physics, nano-photonics, quantum information science, and condensed matter physics. Furthermore, ATOMNANO will involve close collaborations with leading experimental groups in these fields to rapidly identify and coordinate the most promising and fundamentally new avenues for future research.

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**NBR: 322114** **ACRONYM: HETMAT** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2012-CIG** **Thema:** FP7-PEOPLE-2012-CIG

**Title:** Heterostructure Nanomaterials for Water Splitting

**Abstract:** The aim of this project is to synthesize and assemble novel nanomaterials for the purpose of water splitting through a rational design process. To achieve efficient water splitting we want to mimic photosynthesis in green plants by using the so-called Z-scheme. Briefly, the Z-scheme consists of two photosystems abbreviated as PSI and PSII. When the photosystems are illuminated with light, electrons both in PSI and PSII are excited to a higher level. Due to the specific band offset in these photosystems the photogenerated electrons in PS II are transferred to the highest occupied molecular level of PS I. These electrons then recombine with holes photogenerated at PS I. While the photogenerated electrons in PS I participate in reduction of protons to produce hydrogen, the holes in PSII oxidizes water molecules, producing oxygen. By mimicking such a Z-scheme, we expect the probabilities of charge recombination to decrease significantly, resulting in more efficient hydrogen generation. We want to design novel nanomaterials by modifying a Z-scheme type system with the following changes: 1) to engineer an interface between two different nanomaterials or to link them using a solid state electron mediator, 2) to synthesize a single heterostructure material that meets the band offset requirements, and 3) to selectively deposit metal nanoparticles only on the semiconductor phases designated as PSI. Introducing modifications into a Z-type-scheme will offer the capability of using semiconductors with band gaps less than thermo-dynamical limit (1.23 eV/pH=0) for water splitting and improve photostabilities of many catalysts. The project will primarily aim at boosting the photocatalytic activities of nanomaterials for overall water splitting i.e. attaining a quantum yield above 6.3 % at 420 nm. From the perspective of commercialization, templating systems combined with wet-chemistry synthetic routes will be developed for the preparation of the nanomaterials.

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**NBR: 322124** **ACRONYM: BIOSILICA FORMATION** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2012-CIG** **Thema:** FP7-PEOPLE-2012-CIG

**Title:** A Multi-Spectroscopic Investigation of Protein Structure in Biosilica Composites

**Abstract:** We propose to use sum frequency generation (SFG), near edge X-ray absorption fine structure (NEXAFS) and solid state NMR spectroscopy to explore the structural basis for the control exerted by basic peptides on biosilica morphology. The long-term objective of this research is to elucidate the molecular recognition mechanisms used by proteins to control biomineralization processes. The questions we ask are: What is the structural basis for protein recognition of their native mineral phases? What structural motifs do proteins use to interact with mineral phases, and what amino acid side chains orient proteins at mineral interfaces? Answers to these questions would expand not only our understanding of the role played by proteins in biomineralization, but would also provide clear structure-based principles for the design of biomaterials and biomedical devices. However, due to the difficulties in studying protein structure and function at inorganic solid surfaces, there is still remarkably little known of the molecular structure-

function relationships that govern hard tissue engineering by proteins. We know far less about the structures of proteins at biomineral interfaces than we know about the structures of membrane proteins. In this proposal we focus on protein regulation of biosilica morphology. It is widely recognized that proteins regulate formation of silica-based cell walls in diatoms. We propose to use a variety of spectroscopies that we have adapted for use in studying biomaterials, to determine how proteins direct the formation of silica-based nanospheres, nanotubules and other structures.

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**NBR: 322129** **ACRONYM: MUFIN** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2012-CIG** **Thema:** FP7-PEOPLE-2012-CIG

**Title:** Multifunctional Fibre Nano Composites

**Abstract:** The subject of this proposal is the development of fibre-reinforced polymer (FRP) composites with mechanical properties in the high-performance range, electrical and thermal conductivities superior to those of carbon fibre composites. The FRPs will be produced using a bottom-up process, based on macroscopic fibres made of carbon nanotubes (CNTs), a new form of high-performance fibre with mechanical properties in the high performance range (1-6 GPa strength, 50-250 GPa stiffness), high electrical (1x106 S/m) and thermal conductivity (150 W/mK), yarn-like structure, high surface area (200-400m2/g) and which can be produced from natural gas in a one-stage process. The CNT fibres will be used to make FRPs manufactured using established techniques such as resin transfer moulding (RTM) and pultrusion. The structure of the nanocomposites will be tailored at different scales, from the nano to the macro, to maximise multifunctionality. Tailoring will be achieved by controlling the following parameters: type of nanotubes synthesised (aspect ratio, number of layers), fibre architecture (porosity, surface area, CNT orientation), and fibre-matrix interaction (sizing, functionalisation).

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**NBR: 322153** **ACRONYM: MINE** **EC FUND: 75000**

**DG:** REA **Call: FP7-PEOPLE-2012-CIG** **Thema:** FP7-PEOPLE-2012-CIG

**Title:** Developing New Strategies for the Production of Viable Hybrid Nanocrystals with Applicability in Energy Conversion and (Photo)catalysis.

**Abstract:** The main objective of the 3 years research activity herein described is the design and development of protocols for the colloidal synthesis of a new generation of multi-component hybrid nanocrystals (HNCs) with precisely tunable properties and applicability in energy conversion, (photo)catalysis and environmental remediation. In

this context, MINE aboard the most problematic points related to the growth of multi-component materials, in particular the conditions by which it is possible to tune both, the materials that compose the structure and the morphology of the final structure (core-shell or oligomer-like configurations), by integrating the synthesis, the structural characterization and the study of NC properties. Among all the systems we will focus on the design and development of synthetic strategies for the production of metal-semiconductor, metal-semiconductor oxide and metal-metal oxide. The research activity has been divided in four different parts: i) the development of synthetic strategies for the production of multicomponent hybrid NCs, ii) the characterization and study of their physico-chemical properties, reactivity and structure-activity relationships iii) the study of their applicability and iv) the determination of their long-term use in terms of safety, sustainability and feasibility, a necessary step before promoting the "real" applications of these novel exciting nanostructures.We expect that results arising from MINE, will allow not only preparing new and long sought materials, but also re-designing many of the existing materials and recipes, and therefore moving the state of the art to the next step, which can be seen as the fifth-generation of NCs by design

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**NBR: 322158** **ACRONYM: ARTEN** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2012-CIG** **Thema:** FP7-PEOPLE-2012-CIG

**Title:** Artificial Enzymes: Protein-Encapsulated Inorganic Nanoparticles

**Abstract:** Enzymatic catalysis is one of the key processes for biochemical conversion in nature and of utmost importance for any form of life. The base for this kind of conversion is the enzyme itself, which is a very specialized protein targeting another molecule, peptide, or protein in a very specific way to convert it into a product with a minimum of activation energy. The latter point is very critical as it allows biochemical reactions at physiological conditions. This specialization to physiological conditions is, although beneficial for natural processes, very often a drawback for technological processes. Enzymes, being proteins, in most cases cannot resist serious deviations in temperature or pH values and degrade. This operating window of the enzymes limits their flexibility for ex vivo application in technical synthesis, food processing, etc., seriously. Inorganic nanoparticles (NPs) are considered to be a very promising alternative to enzymes as they might increase the operating window for the catalytic reaction. The research direction resembles a sort of molecular biomimetics, since inorganic phases are supposed to mimic biomaterials (enzymes) in their function. Few examples of enzyme-mimicking inorganic nanoparticles have been investigated until now, with the most prominent particles consisting of Fe3O4, CeO2, or Pt. This project aims to go far beyond the current state of the art. With protein-encapsulated inorganic nanoparticles the goal is one the one hand to gain knowledge on enzyme-analogue catalytic reactions with various inorganics and on the other hand to approach application fields of such

composite inorganic enzymes by controlled modification of the protein shell they are embedded in.

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**NBR: 322249** **ACRONYM: DNALIGHTMAP** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2012-CIG** **Thema:** FP7-PEOPLE-2012-CIG

**Title:** Mapping structural variation on native chromosomal DNA â€“ a single molecule approach

**Abstract:** This proposal seeks to utilize single molecule optical detection to directly visualize and analyze genome structural and copy number variation (SVs & CNVs) spanning up to hundreds kb of native chromosomal DNA . The project focuses on a pathogenic macro satellite repeat in the subtelomere of chromosome 4q that is linked to the third most common inherited muscular dystrophy, Facioscapulohumeral muscular dystrophy (FSHD). Specific sequences on subtelomeres are labeled with fluorescent molecules via enzymatic reactions to create a unique, chromosome specific fluorescence pattern. The DNA is then stretched in thousands of parallel nanochannels by electrophoresis and imaged on a fluorescence microscope. The resulting patterns along the DNA backbone are compared to a reference map computed from the known genome sequence and variations from the reference are classified and characterized. Specifically, we will be able to count the exact number of repeat blocks in pathogenic vs. non-pathogenic chromosomes. The immediate outcome of this project is a powerful diagnostic tool for FSHD and a proof of principle for single molecule, high throughput structural variation analysis on a genomic scale.

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**NBR: 322298** **ACRONYM: DECIPAIN** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2012-CIG** **Thema:** FP7-PEOPLE-2012-CIG

**Title:** An integrated approach towards drug discovery and target validation for pain

**Abstract:** Chronic and neuropathic pain, usually diagnosed as spontaneous pain, hypersensitivity to pain or both, is a maladaptive response of the organism to injury and inflammation. Finding new effective drugs to treat these debilitating conditions has shown particularly difficult, as compounds showing good efficacy in preclinical models often fail to meet clinical trials endpoints. A commonly accepted explanation for this discrepancy is that virtually all preclinical analgesic tests have only limited predictability, as they are based on models of evoked pain, whereas patients mainly seek relief of spontaneous pain. To fill the gap in our knowledge of the mechanism of spontaneous pain and to accelerate the discovery process towards better analgesics, we propose to implement a new in vivo

platform for deciphering pain pathways in animal models of spontaneous pain. A new electrophysiological approach, high throughput microneurography (HT-MNG) will be implemented by using in house nanotechnology and microelectronics. This approach will be combined with in vivo RNA interference and optogenetics and validated by specifically addressing targets known to be involved in chronic and neuropathic pain conditions. The proposed preclinical in vivo platform has a great translational potential, as HT-MNG recordings from animal models will provide data directly comparable to those from human patients. Thus, we expect our project to significantly contribute in avoiding expensive failures in Phase II and Phase III pain studies due to lack of drug efficacy. Moreover, by opening the possibility to measure and recognize specific excitability patterns in peripheral neuropathies, the project can help identify patients more likely to respond to a particular drug, dose or regime, thus opening new opportunities for personalized medicine.

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**NBR: 322346** **ACRONYM: ITRANS** **EC FUND: 62500**

**DG:** REA **Call: FP7-PEOPLE-2012-CIG** **Thema:** FP7-PEOPLE-2012-CIG

**Title:** Ion Transport at atomic level

**Abstract:** Cell membranes provide compartmentalization and allow cells to keep their physical-chemistry balance. Ion transport across cell membranes is vital for life, establishing and maintaining a difference of electrochemical potential. From the biosynthesis of energy to the transport of solutes, ion transport is central to the energy transduction process. One of key players in the energy transduction process is the respiratory Complex I (NADH:ubiquinone oxidoreductase. This membrane domain of Complex I has three homologous antiporter subunits where the proton channels are proposed to be located. Recently, new results indicate that Complex I from different bacteria are also able to transport H+ and Na+ in opposite directions. This data prompt the debate on the atomic mechanism behind such antiporter subunits and how such process can be regulated. The aim of this project is to provide the missing piece of behind the antiporter subunits puzzling mechanism. To approach such task two objectives have been draw: a) decipher the mechanism of ion transport of the antiporter subunits of Complex I at atomic level, b) unravel the how the regulation and control of ion transport is performed in Complex I antiporter subunits To pursue these objectives a novel sample preparation methodology to perform NMR spectroscopy of membrane proteins will be setup. This experimental setup will combine recent advances in cell-free expression system of membrane proteins with nanodisc technology, providing the antiporter subunits a native membrane like environment to perform solution NMR.To follow ion transport, the antiporter subunits will be selectively isotopic labelled and the NMR spectra will be monitored for changes upon ion transport. These changes will provide a map of the ion channel in the antiporter subunits and how this transport is regulated.

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**NBR: 322408** **ACRONYM: AMYTOX** **EC FUND: 2498465**

**DG:** ERCEA **Call: ERC-2012-ADG_20120314** **Thema:** ERC-AG-LS1

**Title:** Amyloid fibril cytotoxicity: new insights from novel approaches

**Abstract:** Despite the discovery of amyloidosis more than a century ago, the molecular and cellular mechanisms of these devastating human disorders remain obscure. In addition to their involvement in disease, amyloid fibrils perform physiological functions, whilst others have potentials as biomaterials. To realise their use in nanotechnology and to enable the development of amyloid therapies, there is an urgent need to understand the molecular pathways of amyloid assembly and to determine how amyloid fibrils interact with cells and cellular components. The challenges lie in the transient nature and low population of aggregating species and the panoply of amyloid fibril structures. This molecular complexity renders identification of the culprits of amyloid disease impossible to achieve using traditional methods. Here I propose a series of exciting experiments that aim to cast new light on the molecular and cellular mechanisms of amyloidosis by exploiting approaches capable of imaging individual protein molecules or single protein fibrils in vitro and in living cells. The proposal builds on new data from our laboratory that have shown that amyloid fibrils (disease-associated, functional and created from de novo designed sequences) kill cells by a mechanism that depends on fibril length and on cellular uptake. Specifically, I will (i) use single molecule fluorescence and non-covalent mass spectrometry and to determine why short fibril samples disrupt biological membranes more than their longer counterparts and electron tomography to determine, for the first time, the structural properties of cytotoxic fibril ends; (ii) develop single molecule force spectroscopy to probe the interactions between amyloid precursors, fibrils and cellular membranes; and (iii) develop cell biological assays to discover the biological mechanism(s) of amyloid-induced cell death and high resolution imaging and electron tomography to visualise amyloid fibrils in the act of killing living cells.

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**NBR: 322699** **ACRONYM: THE FUSION MACHINE** **EC FUND: 2165200**

**DG:** ERCEA **Call: ERC-2012-ADG_20120314** **Thema:** ERC-AG-LS5

**Title:** The nanomechanical mechanism of exocytotic fusion pore formation

**Abstract:** Cells release neurotransmitters, hormones and other compounds stored in secretory vesicles by a process called exocytosis. In this process, the molecules are released upon stimulation by a nanomachine forming a fusion pore that connects the vesicular lumen

to the extracellular space. Similar fusion events are also essential for intracellular transport mechanisms and virus-induced fusion. Here I propose a multidisciplinary approach using highly innovative techniques to determine the nanomechanical mechanism of fusion pore formation. The proposal is based on the hypothesis that the vesicle fusion nanomachine is formed by the mechanical interactions of the SNARE proteins synaptobrevin, syntaxin, and SNAP-25 and that the fusion pore is opened by intra-membrane movement of the transmembrane domains. I will combine fluorescence resonance energy transfer microscopy with detection of individual fusion events using microfabricated electrochemical detector arrays to demonstrate that fusion pore formation is produced directly by a conformational change in the SNARE complex. I will estimate the energies that are needed to pull the synaptobrevin C terminus into the hydrophobic membrane core and the forces that are generated by the SNARE complex for wild type and a set of specific mutations using molecular dynamics simulations. I will determine how these energies and forces relate to inhibition and facilitation of experimentally observed fusion, performing patch clamp capacitance measurements of vesicle fusion in chromaffin cells expressing wild type and mutated SNARE proteins. Based on these results I will develop a detailed picture of the molecular steps, the energies, and the forces exerted by the molecular nanomachine of fusion pore formation and will ultimately generate a molecular movie of this fundamental biological process. Understanding cellular and viral fusion events will likely lead to novel treatments from spasms and neurodegeneration to cancer and infectious disease

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**NBR: 322972** **ACRONYM: NANO-ISLANDS** **EC FUND: 2244000**

**DG:** ERCEA **Call: ERC-2012-ADG_20120314** **Thema:** ERC-AG-LS6

**Title:** NANOSCALE ANALYSIS OF PROTEIN ISLANDS ON LYMPHOCYTES

**Abstract:** To detect foreign invaders and to communicate with other cells of the immune system, B lymphocytes carry a multitude of receptor proteins on their surface. In the past, it was thought that most of these receptors are randomly distributed on the cell surface and only become organized upon lymphocyte activation. Recent studies showed, however, that many of these surface proteins are pre-organized in nanoscale protein islands (here called nano-islands) with a size of 50-150 nanometer (nm). We have developed a Fab-proximity ligation assay (Fab-PLA) which allows us to study the organization of membrane proteins at 10-20 nm distances. With this method, we discovered that the B cell antigen receptor (BCR) of the classes IgM and IgD are located in different class-specific nano-islands. Due to the technical limitations of classical biochemistry (detergent lysis), light microscopy (diffraction limit of 250 nm) and electron microscopy (fixation artifacts), the nanoscale organization of membrane proteins is not well studied. With the Fab-PLA method, we can, for the first time, explore this unknown 200-20 nm space and analyze the composition and stability of the different nano-islands on the B cell surface. We also will develop new methods such as proximity biotinylation and

proximity proteomics to better study these nanostructures and learn more about their role in B lymphocyte activation and human diseases such as lymphomas and autoimmune diseases. Although more than 50% of all drugs target membrane proteins, the nanoscale organization of these proteins is poorly characterized. To learn more about the nano-islands organization of membrane proteins is thus of utmost importance for a better understanding of the action of these drug treatments and to improve them. Our study may also provide better markers for specific disease stages and could lead to new drugs influencing nanoscale membrane processes.

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**NBR: 323053** **ACRONYM: LYMPHIMMUNE** **EC FUND: 2499636**

**DG:** ERCEA **Call: ERC-2012-ADG_20120314** **Thema:** ERC-AG-LS4

**Title:** Flow in the tumor microenvironment: Linking mechanobiology with immunology

**Abstract:** Tumors often engage the lymphatic system to invade and metastasize. The tumor-draining lymph node (dLN) may be an immune privileged site that protects the tumor from host immunity, and lymph flow draining tumors is often increased, enhancing communication between the tumor and the sentinel node. In addition to increasing transport of tumor antigens and regulatory cytokines to the lymph node, increased lymph flow in the tumor margin causes mechanical stress-induced changes in stromal cells that stiffen the matrix and alter the immune microenvironment of the tumor. In this proposed project, we will investigate the interplay between lymphatic drainage and flow-induced mechanotransduction in the tumor stroma that may synergize to promote tumor immune escape by appropriating lymphatic mechanisms of peripheral tolerance. We will address the hypothesis that lymphatic drainage and flow-induced mechanotransduction in the tumor stroma synergistically promote tumor immune escape by altering the immune microenvironment, and that targeting lymphatic drainage from the tumor may represent a new avenue for tumor immunotherapy. For the latter, we will develop strategies to limit or block lymphatic flow in the tumor microenvironment and characterize their ability to improve the efficacy of tumor immunotherapy by dampening local immunosuppression in the tumor stroma and tumor-draining lymph node (dLN). We will combine in vivo mouse models and intravital imaging with engineered in vitro microenvironments and nanoparticle-based targeting strategies in three broad aims designed to constitute several PhD and postdoctoral projects.

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**NBR: 324275** **ACRONYM: DECENT AID** **EC FUND: 1492545**

**DG:** REA **Call: FP7-PEOPLE-2012-IAPP** **Thema:** FP7-PEOPLE-2012-IAPP

**Title:** Novel drug delivery system produced by centrifugal technologies â€“ composed to minimize adverse immune reactions and designed for optimised therapeutic effects

**Abstract:** Drug delivery systems are a matter of intensive scientific investigation and technological developments. They are necessary since many active pharmaceutical ingredients to be employed in therapy, diagnostics or vaccination cause serious side effects when distributed non-specifically. Without a drug delivery system, the active pharmaceutical ingredients may accumulate in healthy and sensitive tissue, provoke adverse immune reactions, have poor solubility, low bioavailability and inefficient targeting. To meet these challenges, the key objectives of the proposed project are the development and testing of an innovative production technology for nanocapsules as a drug delivery system using centrifugation, colloidal and fluid mechanical techniques. These novel nanocapsules should be especially suited for proteins and other sensitive biomolecules which are vulnerable to degradation by existing encapsulation technologies. An immune protection consisting of a suitable polymer cover of the nanocapsules has to be developed to enable long circulation in human blood without provoking innate immune reactions by the complement, the coagulation and the phagocytic systems. Other than established polymer protection systems, the novel polymer protection should not be immunogenic to avoid accelerated blood clearance upon repeated administration. The nanocapsules have to prove to be sufficiently stable in human blood ex vivo. In vitro and in vivo tests in cancer models will be performed to compare drug efficiency, immune reactions and organ distribution of encapsulated and non encapsulated active pharmaceutical ingredients. Multidisciplinary research and innovation for nanomedicine is aimed for by collaboration in an intersectoral research team comprising mechanical and process engineering, pharmaceutical technology, immunology and cancer research.

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**NBR: 324292** **ACRONYM: BIOFUR** **EC FUND: 920563**

**DG:** REA **Call: FP7-PEOPLE-2012-IAPP** **Thema:** FP7-PEOPLE-2012-IAPP

**Title:** BIOpolymers and BIOfuels from FURan based building blocks

**Abstract:** The BIOFUR project consists of three partners. The SME Avantium Chemicals (AVT - NL), selected as one of the Cleantech top 100 companies in 2011 and the Centre National de la Recherche Scientifique (CNRS - FR) and the University of Messina (UNIME - IT), both leaders in their respective fields. This multi-sectorial research work will contribute to breakthrough knowledge on the catalytic furanic conversion fundamentals and will be necessary for a sustainable technological development of these novel polyester materials and fuels based on renewable resources. The project consist of three workpackages: WP1: Production, Characterization, Optimisation and Environmental Impact of the Production of Polyesters; WP2: Development of Nanostructured Catalysts to improve the Performances and Sustainability of the Catalytic Conversion and Upgrading of Furanics, and; WP3: Managerial, Interdisciplinarity, Intersectoral and

Dissemination aspects. The BIOFUR project shows that the proposed knowledge transfer for the three host organizations through the secondment of their own staff and the recruitment of researchers from outside the partnership is very beneficial for the host organizations by significantly increasing their research quality and overall RTD capabilities and competitiveness. The proposed dissemination and outreach activities will make sure that also to the greater European community will benefit from this project. The Coordinator of the BIOFUR project is Dr. Ed de Jong of AVT and the other lead researchers are Prof. Gabriele Centi of UNIME and Prof. Nicolas Sbirrazzuoli of CNRS.

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**NBR: 324385** **ACRONYM: REBRAKE** **EC FUND: 2061716**

**DG:** REA **Call: FP7-PEOPLE-2012-IAPP** **Thema:** FP7-PEOPLE-2012-IAPP

**Title:** 50% Reduction of Brake Wear Particulate Matter

**Abstract:** Particulates, also known under the name of particulate matter (PM), are fine particles or soot. Particulate matter is frequently classified according to its size, i.e. PM10, PM2.5 and PM0.1 for particulates with an aerodynamic diameter D smaller than, respectively, 10 µm, 2.5 µm and 0.1 µm. PM represent an hazard for human health. Very coarse particles (D >10 µm) are generally filtered in the nose and throat via cilia and mucus. Coarse particles (2.5 µm< D< 10 µm) can settle in the bronchi and lungs. Fine particles (0.1 µm< D< 2,5 µm) can easily penetrate into the lungs gas exchange regions, and they might cause vascular inflammation related diseases and possibly lung cancer. Ultrafine particles (D< 0.1 µm) or nanoparticles might be even more dangerous, as they can reach intimate structure of tissues and organs and act as nucleations sites for cancer and degenerative pathologies.. Despite the emissions of PM2.5 and PM10 decreased by 16% and 21 respectively between 1999 and 2009, PM limits were exceeded widely across the EU area, a quite discouraging result. Whilst exhaust gases in the road transport are monitored and object of the European directives, less is known about the particulates originating from the wear of e.g. brakes and tyres. A recent study for the city of London regarding 2011 and future 2015 PM emissions, estimated a consistent increase of the PM wear emissions (brakes and tyres) with respect to the overall PM emissions: from 35% to 47% for PM10 and from 40% to 55% for PM2.5 The REBRAKE ultimate and tangible objectives aims at: i) at least 50% particulate matter (PM10) mass reduction from brake wear, in compliance with the EU2020 thematic strategy of 47% reduction of particulate matter by 2020; ii) deeper comprehension of the physical and chemical phenomena underlying the brake wear process, including higher comprehension and analysis of characteristics coarse, fine and UFP particles.

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**NBR: 324386** **ACRONYM: FIBROGELNET** **EC FUND: 910726**

**DG:** REA **Call: FP7-PEOPLE-2012-IAPP** **Thema:** FP7-PEOPLE-2012-IAPP

**Title:** Network for Development of Soft Nanofibrous Construct for Cellular Therapy of Degenerative Skeletal Disorders

**Abstract:** High incidence of degenerative skeletal tissue disorders in a progressively aging human population make tissue engineering of cartilage and bone a focus of extensive research. Bone and joint disorders are the most common disease in Europe: more than 100 million European citizens suffer from arthritis and 19 million people have osteoporosis (one of three women and one of eight men are affected). This proposal is designed to supplement the existing EuroNanoMed project aimed to develop an innovative strategy for targeting bone and cartilage regeneration. More specifically the proposal seeks to set up an international multidisciplinary team of young scientists and engineers representing both academia and industry partners that will strongly contribute to the design of a novel type of implant, which can strongly promote tissue regeneration combining high performance materials, advanced nanotechnology and living cells.

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**NBR: 324443** **ACRONYM: SANAD** **EC FUND: 2872668**

**DG:** REA **Call: FP7-PEOPLE-2012-IAPP** **Thema:** FP7-PEOPLE-2012-IAPP

**Title:** Synthesis of Advanced top Nano-coatings with improved Aerodynamic and De-icing behavior

**Abstract:** The efficiency of modern transportation is severely compromised by the prevalence of turbulent drag and icing. The high level of turbulent skin-friction occurring, e.g., on the surface of an aircraft, is responsible for excess fuel consumption and increased carbon emissions. The environmental, political, and economic pressure to improve fuel efficiency and reduce carbon emissions associated with transportation means that reducing turbulent skin-friction drag is a pressing engineering problem. The current project will tackle this problem with the development of superhydrophobic nanostructured top coatings, which do not only exhibit improved aerodynamic efficiency but at the same time they prevent icing on the aircraft. The nanostructured coatings will be based on metal oxides or nanostructured carbon (carbon nanotubes or graphene). Both types of nanoparticles can become superhydrophobic by suitable surface treatment while nanostructured carbon can also thermally activate the coating using the plane's on-board electrical system. The proposed project involves the synthesis and chemical modification of ad-hoc nanoparticles. The latter will be employed for the synthesis of novel composite coatings, based on epoxy or polyacrylic resins, which will be characterized to obtain information on the structure and topology of the coatings. Wind tunnel tests, in combination with fluid dynamics modeling, will be conducted to optimise the application methods and the effect of different substrates, icing fluids,

contaminants etc., thus correlating the aerodynamic and de-icing behavior to the morphology of the material. The performance of the developed coatings will be compared with that of existing coatings already produced by a partner of the consortium. The material with the most promising characterization data will be produced in large-scale and provided to the partner “British Airways” for applying it as outer coating in three aircrafts for testing it in flight conditions.

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**NBR: 324449** **ACRONYM: ALBATROSS** **EC FUND: 844602**

**DG:** REA **Call: FP7-PEOPLE-2012-IAPP** **Thema:** FP7-PEOPLE-2012-IAPP

**Title:** Assembling Langmuir-Blodgett Architectures Through the use of Roll-to-roll Systems

**Abstract:** The proposal addresses each of the three elements of the so-called 'knowledge triangle', i.e. research, innovation and education. The proposed programme is based partly on nationally funded multidisciplinary (Photonics, Nanoelectronics, Chemistry, Materials Science) projects that have been recently awarded to the partners from Academia and is designed to provide added value from the obvious synergies between these projects. The complementarity will enable the consortium to develop novel products using SiO2/TiO2 nanoparticles for improving the properties of solar cells and OLEDs/ OFETs that the first SME partner aims to bring into production. The equipment innovation comes from the planned systematic modifications and improvements to both hardware and software and improvement to both hardware and software of a roll-to-roll Langmuir-Blodgett dipper mechanism that has been developed by the second SME partner. We aim at making the final device attractive for potential customers by modifying the existing prototype so that it is compatible with other equipment (LB troughs) aleady available on the market. The educational and training value of the project is also high in that a number of secondments of research personnel are envisaged, including PhD students. The enhanced commercial opportunities of the device will give the research community direct means of preparing complex photonic and nanoelectronic structures on flexible substrates using a wide range of materials. The innovative roll-to-roll (R2R) mechanism will therefore facilitate the possibility of using the LB technique in a range of new commercially scalable production processes, enabling us to take this technology out of the laboratory and into the factory environment - which will be a truly revolutionary accomplishment and one which is directly aligned with EU requirements.

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**NBR: 324459** **ACRONYM: LASERMICROFAB** **EC FUND: 1125353**

**DG:** REA **Call: FP7-PEOPLE-2012-IAPP** **Thema:** FP7-PEOPLE-2012-IAPP

**Title:** Laser Digital Micro-Nano fabrication for Organic Electronics and Sensor applications

**Abstract:** LaserMicroFab proposes a joint research programme exploiting on the knowledge and expertise of two academic partners (National Technical University of Athens (NTUA) and CNRS-LP3) and one SME, Oxford Lasers (OL) through inter-sectorial exchange of knowledge, networking activities and training in the areas of advanced laser processing for organic electronic devices and biosensors. The goal for this project is to develop Laser digital micro-fabrication processes such as selective laser micro and nano-patterning, laser micro-curing and laser micro-printing for precision patterning of complex materials, such as metallic nanoparticle (NP) inks and organic materials. The developed laser processes will be employed for the micro-curing of metallic nanoparticle (NP) interconnects to achieve submicron spatial resolution, for the nanostructuring of ultrathin (

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**NBR: 324514** **ACRONYM: EPICSTENT** **EC FUND: 1024185**

**DG:** REA **Call: FP7-PEOPLE-2012-IAPP** **Thema:** FP7-PEOPLE-2012-IAPP

**Title:** Antibody-functionalised cardiovascular stents for improved biocompatibility and reduced restenosis

**Abstract:** An industry-academia collaboration is proposed wherein two industry and three academic partners will establish a lasting, inter-national partnership for transfer of knowledge in biomaterials engineering. The partners have synergistic competences in the medical device sector, and, aided by a schedule of staff secondments and networking events, their relevant niche expertise will be shared and transferred intersectorally. In all 16 researchers will be supported. Coronary artery disease accounts for two million deaths per year in Europe. The long-term outcome for patients is poor: 15% die or experience re-infarction within 30 days of initial diagnosis, while over 30% are re-hospitalised within 1 year. The estimated cost to the EU economy is €192 billion/year. The over-riding S&T objective of this collaboration is to develop a biomimetic cardiovascular stent prototype, by surface functionalisation with human antibody fragments, for improved coating by epithelial precursor cells in vivo. Sophisticated protein engineering and (nano)materials analysis from academic partners will interface with focused manufacturing and market experience of industry partners to deliver a stent with improved biocompatibility, reduced re-narrowing of arteries and superior clinical performance. Partners in interventional cardiology and industrial stent manufacturing will ensure clinical relevance and market-driven focus throughout design, development and post-project market entry. The collaboration will develop skill sets of individual researchers, strengthen research capacity at partner institutions and support important extant biomedical device clusters in Ireland and Poland. The clinical end product will significantly improve patient outcomes and quality of life for Europe's citizens; reduce costs for health care providers; and strengthen the European biomedical

industry, leading to creation / retention of wealth in Europe and job creation in the European medical devices sector.

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**NBR: 324564** **ACRONYM: SI-BONE-POC** **EC FUND: 149366**

**DG:** ERCEA **Call: ERC-2012-PoC** **Thema:** ERC-OA-2012-PoC

**Title:** Silica-based Nanobiomedical Approaches for Treatment of Bone Diseases: Proof-of-Concept

**Abstract:** Silicatein is a unique enzyme from siliceous sponges that is able to catalyze the formation of an inorganic material, silica or "biosilica" which forms the inorganic skeleton of these sponges. Another exceptional property of this protein is its dual function, as we discovered for the first time in the ERC Advanced Grant "BIOSILICA" (Grant no. 268476): silicatein both (i) acts as an enzyme (biosilica formation) and (ii) exhibits structure-forming/guiding activity. Even more important with regard to the biomedical application of silicatein: the product of the enzymatic reaction, biosilica, is osteogenic and biocompatible and allows the formation of a moldable material – the ideal basis for the potential application in bone healing, as we found. Moreover, we demonstrated that biosilica not only increases the expression of bone morphogenic protein 2 (BMP-2), but also modulates the ratio of expression of two proteins, osteoprotegerin (OPG) and RANKL, that are crucial in pathogenesis of osteoporosis. Hence, biosilica has potential in prophylaxis and therapy of osteoporosis, a major health threat worldwide. Measures to prevent the development of osteoporosis have become increasingly important due to the demographic development in many industrialized countries. Our idea arising from the ERC-funded project is to apply the silica-enzymes fused to a hydroxyapatite-binding protein tag for the formation of bioactive biosilica-based scaffold / nanocomposite materials for bone regeneration and repair in osteoporotic patients and patients with related bone diseases. The proposed project aims at bringing this idea to a pre-demonstration stage by conducting a proof of concept and verifying its innovation potential. The potential commercialization opportunities and the IPR position of this idea will be clarified.

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**NBR: 324571** **ACRONYM: MEDIF-2** **EC FUND: 150000**

**DG:** ERCEA **Call: ERC-2012-PoC** **Thema:** ERC-OA-2012-PoC

**Title:** Medical Applications of IF nanoparticles

**Abstract:** Back in 1992 we have found that nanoparticles of inorganic compounds with layered (2D) structure, including MoS2, NiBr2, Cs2O and many others, form hollow closed

nanostructures- i.e. fullerene-like nanoparticles (IF) and nanotubes (INT). These nanoparticles serve as very good solid lubricants and are now exploited commercially. Using the leverage of the ERC project we have recently made major progress with the synthesis of new IF and INT, including SnS2 nanotubes and MoS2 nanooctahedra. We also found that Re doping of the these nanoparticles leads to remarkable changes in their physio-chemical behavior, including making them superlubricants (friction coefficient approaching 0.01). Based on these advancements, in both the materials synthesis and bio-medical studies, we propose to develop a number of new medical technologies which will be licensed to a start-up company at the end of this project. In order to achieve this goal we will employ a multifaceted technological approach. 1. Develop new self-lubricating coatings based the IF nanoparticles; 2. Explore a number of promising new medical applications which are associated with the low friction and surface energy of the IF NP, and 3. Embark on extensive bio-toxicity-bio-compatebility studies.

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**NBR: 324660** **ACRONYM: COOL-HRTEM** **EC FUND: 149953**

**DG:** ERCEA **Call: ERC-2012-PoC** **Thema:** ERC-OA-2012-PoC

**Title:** A double tilt cryoholder for ultra high resolution transmission electron microscopy at low temperatures

**Abstract:** The transmission electron microscope (TEM) is an essential instrument facilitating studies of the nanoscale material structure at sub-1Å resolution for R&D in the area of materials science, nanoscience and nanotechnology. In order to access the highly relevant temperature range between 77 K and room temperature, special specimen cryoholders need to be used that allow for a double tilt of the specimen under study. However, it is impossible to make images with sub-1Å resolution with the existing commercial double-tilt cryoholders. This is due to effects of thermal gradient-induced drift and mechanical vibrations. As part of my ERC Advanced Grant I have pioneered single-tilt cryoholders with electrical feedthroughs that largely overcome these problems, resulting in sub-1Å high resolution TEM at ~100 K in at least 15% of the images that are recorded. With this proposal, I wish to take these advances towards a proof of concept for a double-tilt cryoholder that allows sub-1Å high-resolution TEM in at least 80% of the recordings at any temperature between 77 K and 300 K and represents a user-friendly standard technique with commercial potential. I plan to make these holders available to researchers at similar price levels of currently available holders. Based on my acknowledged track record in developing microscopy innovations, I have drafted a plan to prototype this invention. I will seek an industrial partner to perform a design cycle for real production, and next produce the holders.

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**NBR: 326054** **ACRONYM: NEPTUNE** **EC FUND: 202405**

**DG:** REA **Call: FP7-PEOPLE-2012-IIF** **Thema:** FP7-PEOPLE-2012-IIF

**Title:** New generation of ion sources: from deep space missions to upstream nano-technologies

**Abstract:** The main goal of the proposed NEPTUNE project ("New generation of ion sources: from deep space missions to upstream nano-technologies") is to enhance the understanding of the physics and exploit the benefits of bipolar charged particle extraction from low temperature plasma. The first NEPTUNE prototype will be built and tested during the project implementation. In the NEPTUNE prototype the generated particle beam will be quasi-neutral, composed by ions and electrons or oppositely charged ions, without the need for an additional neutralization system. The NEPTUNE project brings together scientists who are experts in the area of formation of flows of oppositely charged particles, in order to address key fundamental issues at the leading edge of the subject: simultaneous bipolar particles extraction, space charge neutralization in complex systems and plasma - bipolar beam interactions.

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**NBR: 326083** **ACRONYM: EEORR** **EC FUND: 231283**

**DG:** REA **Call: FP7-PEOPLE-2012-IIF** **Thema:** FP7-PEOPLE-2012-IIF

**Title:** Engineering Graphene/Multimetal Composite with Ionic Liquid as Enhanced Electrocatalysts for Oxygen Reduction Reaction

**Abstract:** Fuel cells are an advanced renewable electrochemical device capable of converting chemical energy to electrical energy. In the quest to make the fuel cells a competitive force, one of the major limitations is still to reduce the overpotential of the oxygen reduction reaction (ORR) at the cathode electrode. Currently, Pt and Pt-based nanoparticles (NPs) are still indispensable, proving to be the most effective catalyst for ORR. However, the high cost of Pt catalyst, together with its limited reserves in nature, has precluded the large-scale commercialization of fuel cells. Another big issue is the poor durability of Pt NP catalyst in the cell's harsh operating alkaline or acidic environment. In this project, based on the excellent chemical and physical properties of graphene and ionic liquid, the designed synthesis of high-performance graphene/multimetal composite catalysts with very high ORR activity and durability through the introduction of IL into composite catalysts was proposed. First, new organic-phase or aqueous-phase synthesis methods for the controlled synthesis of high-quality multimetal Pt-based alloy, core/shell and dumbbell NPs or nanowires will be developed. The effect of composition, shape, core/shell structure and interface synergy of different multimetal nanomaterials on their ORR catalytic activity and stability will be studied.

Then, in order to further enhance ORR performance of multimetal nanomaterials, we will engineer graphene/mutilmetal composite nanosheet with ionic liquid. The introduction of ionic liquid and graphene will have great opportunity for reducing the ORR overpotential and enhancing the ORR activity. Our final aim is to realize high-performance composite nanocatalysts with very high activity and stability for ORR that are superior in performance to all the existing materials.

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**NBR: 326385** **ACRONYM: TANOGAPPS** **EC FUND: 231283**

**DG:** REA **Call: FP7-PEOPLE-2012-IIF** **Thema:** FP7-PEOPLE-2012-IIF

**Title:** Star-like Oligo(aniline)s with Tunable Band Gaps for Tailored Nanostructures in Advanced Electronic Applications

**Abstract:** The overarching aim of the proposed research is to advance the understanding and design of conjugated oligomeric materials with tunable optoelectronic properties, in particular materials based on oligo(aniline)s, for applications in the EU priority area of organic electronics. To underpin and support this innovation, key new routes to novel molecular architectures and nanostructures will be explored. The proposed research deals with the designed synthesis of a library of nanostructures based on star-like oligo(aniline)s from the Buchwald-Hartwig cross-coupling strategy and ionic self-assembly technique. Controlling the molecular architecture and acids dopants will allow for tuning of and controll over band gaps, physical dimensions and localized defects. This approach will lead to optimised nanostructured morphologies and ensure efficient charge separation and transport. As a result, enhanced mobility, sensitivity and selective interactions with external stimuli will offer smart nanomaterials for gas sensors. The project will open unexplored avenues in this priority area of organic electronics through its inter- and multidisciplinary approach, i.e., the proposed research will rely on modern synthetic organic chemistry, chemicophysical analyses of optoelectronic properties and structure relationships, self-assembly in the solid state, device fabrication and testing. It is expected that the outcomes of this proposed research will substantially impact across and beyond the mentioned range of disciplines. This project will therefore 1) aid in continuing to establish European excellence and competitiveness in the field of organic electronics, a priority research area in the European Research Area, and 2) is expected to accelerate the development of selective and tunable sensors, which will have major impact on ERA scientific communities, public health and EU security.

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**NBR: 326641** **ACRONYM: EXSTASY** **EC FUND: 249242**

**DG:** REA **Call: FP7-PEOPLE-2012-IIF** **Thema:** FP7-PEOPLE-2012-IIF

**Title:** Experimental STation for the Analysis of the Spin dYnamics

**Abstract:** The aim of the project is the development of an experimental station for performing experiments on the magnetic properties of materials thanks to the spin analysis of the photoelectrons. This goal will be achieved with the construction of a new UHV station that will be equipped with a vectorial mott detector apparatus already present at the TASC laboratory. The actual mott detector system will be implemented with new electronics and new acquisition software that will permit to perform time resolved experiments. The system will be designed to be fully compatible with the beamlines of the FERMI free electron laser. In this way we will obtain the first vectorial magnetometer with intrinsically high surface sensitivity, well adapted to nanostructures, capable of FEL-range time resolution. The measure of spin polarisation is intrinsecally unaffected by space-charge arising from high FEL intensity allowing the measure also in the extreme intensity conditions of the FEL source. The professor Petrov is a leading expert in the field of the spin analysis and will give an important contribution to the achievement of these goals.

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**NBR: 326665** **ACRONYM: RESPONSIVE** **EC FUND: 202405**

**DG:** REA **Call: FP7-PEOPLE-2012-IEF** **Thema:** FP7-PEOPLE-2012-IEF

**Title:** Responsive Field-Effect Transistors: A Life-Long Training Career Development action

**Abstract:** RESPONSIVE will offer to a young researcher with an extraordinary track record, possessing a Ph.D in chemistry, a cross-disciplinary and supra-sectorial training and research experience in the field of organic electronics at the interface between supramolecular chemistry, solid state physics and electrical engineering in the emerging realms of materials- and nano-science. The overall mission is to train the fellow to become an independent scientist as well as to prepare him for a leading position in academia or industry. RESPONSIVE targets at developing a deep understanding of the underlying mechanisms ruling FETs performance, with a special focus on the control of novel properties and functions emerging from the bottom-up nanostructuration in blended active layers integrating photochromic molecules. In particular photochromic systems will be blended or chemisorbed as self-assembled monolayers (SAMs) at different interfaces (including functionalization of source and drain electrodes, functionalized gate dielectric substrates, etc.) to realise devices featuring switchable conductivity when exposed to different stimuli. Both planar interfaces such as the typical ones present in the devices (electrodes and dielectric substrate) and non-planar, i.e. those based on metallic or semiconducting nanoparticles (NPs) or nanorods (NRs), will be functionalized with responsive SAMs, to influence charge transport at nanoscale in the bulk of the active semiconducting layer. By combining chemical/physical tailoring of the different interfaces in the device, as well as the geometry and composition of the system (e.g. by changing concentration, size and shape of SAM coated NPs or NRs) and

controlling its hierarchical self-assembly at multiple length scales, new and more efficient photoswitchable organic field-effect transistors (OFETs) will be realized, towards the development of multi-gating, thus multifunctional devices.

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**NBR: 326666** **ACRONYM: MULTITUDES** **EC FUND: 202405**

**DG:** REA **Call: FP7-PEOPLE-2012-IEF** **Thema:** FP7-PEOPLE-2012-IEF

**Title:** MULTIfuncTional organic electronics throUgh nanoscale controlleD bottom-up tailoring of interfacES: an Intra-European Fellowship for career development.

**Abstract:** MULTITUDES is aimed at providing multidisciplinary and multisectorial training and mobility to a very promising researcher in order to further his career development so that he may become an independent and leading scientist either in the university or private sector. The researcher will receive training in an emerging field at the interface between Physics Materials-/Nano-/Supramolecular -Science and Electrical Engineering. The research program in MULTITUDES aims to develop both asymmetrically functionalised electrodes and multifunctional devices for organic electronics. This will be achieved by modifying adjacent metal (nano)electrodes with different self-assembled monolayers (SAMs) through a process of chemisorption and selective electrochemical desorption, and will include in this some SAMs that have properties sensitive to light or that can be switched electrochemically to confer additional functionality to the surface and ultimately to the device. Within this framework, MULTITUDES aims to: - Characterise competitive adsorption processes between SAM molecules, and build a library of competitive adsorption/desorption processes between candidate molecules. - Develop protocols for fabrication of asymmetric planar electrodes by adsorption and selective electrochemical desorption of SAM molecules. - Improve control of charge injection into organic field-effect transistors (OFETs) by incorporation of asymmetric SAM functionalised electrodes. - Map the local electrical characteristics of planar OFET devices incorporating asymmetric electrodes whilst under bias using scanning probe techniques in order to improve understanding of the physico-chemical properties ruling operation with a nanoscale spatial resolution. - Fabricate novel devices for application as sensors or as multifunctional logic gates whose properties can be switched between two states through interaction of an external (non-electrical) stimulus with the SAM functionalised electrode.

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**NBR: 326919** **ACRONYM: COCHALPEC** **EC FUND: 184709**

**DG:** REA **Call: FP7-PEOPLE-2012-IEF** **Thema:** FP7-PEOPLE-2012-IEF

**Title:** Development of electrodes based on copper chalcogenide nanocrystals for photoelectrochemical energy conversion

**Abstract:** Solar energy is renewable and abundant enough to meet the growing energy demand, but its variability limits the application. Direct storage in the form of a clean fuel, like hydrogen, would solve this problem. Photoelectrochemical (PEC) cells employ solar energy to split water molecules producing H2 and O2. Thin films of Cu2ZnSnS4 (CZTS) and ZnCuInS2 (ZCIS) have shown remarkable efficiencies in photovoltaics (PV) and preliminary promising results in PEC cells, but costly fabrication. Currently, much attention is being paid to the synthesis of nanocrystals (NCs) of these materials because of their low cost preparation and tunable optical and electrical properties just by controlling the nanometer dimensions of NCs and the composition of the particles, giving more versatility to meet the energetic requirements for water splitting. These new materials in the forefront of PV remain unexplored in water splitting PEC cells to date. In this project, we propose the fabrication of photoelectrodes based on CZTS and ZCIS NCs to perform the water splitting. First, the control over the size, shape and composition of these NCs will be demonstrated using inexpensive solution-based techniques. Next, two photoelectrode configurations (viz. sensitized metal oxide and 3D-arrays of NCs) will be pursued applying state of the art overlayers to improve the charge separation and the catalytic activity at the interface with water. Finally a PEC device will be assembled that demonstrates a 5% overall solar to hydrogen conversion efficiency. In this research we propose a bottom-up approach whereby the comprehensive analysis of the interfacial charge transfer will both contribute to the basic science of solar energy conversion systems and optimize the performance of very promising materials for direct solar to fuel energy conversion. Our approach will finally create a significant impact on the scientific and general European communities through the dissemination of the field and the results.

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**NBR: 327076** **ACRONYM: "RTILS-GELS"** **EC FUND: 309235**

**DG:** REA **Call: FP7-PEOPLE-2012-IIF** **Thema:** FP7-PEOPLE-2012-IIF

**Title:** Novel Delivery Platform for Hydrophobic Drugs

**Abstract:** Underpinned by pharmaceutical-industry estimates that approximately 40% of lipophilic therapeutic molecules are rejected because of their poor aqueous solubility and formulation-stability issues, one of the main challenges facing modern pharmaceutical science is the development of carrier vehicles for the extended delivery of such drug candidates. Additional impetus for such research activities is provided by the potential of such carriers to improve the therapeutic profiles of many of the widely used hydrophobic chemotherapeutants. Nowday, carrier vehicles for the delivery of hydrophobic drugs are associated with several disadvantages: conventional emulsions, micelles and liposomes are thermodynamically unstable; lipophilic carriers cluster in

blood flow and are rapidly opsonized and massively cleared by liver and spleen; loading capacity of hydrophobic drugs into hydrophilic carriers is limited. Rationalised in the terms of thermodynamic stability, capability to move through blood capillaries, imrpoved drug loading capacity, surface-charged hydrophilicity, and capacity to effect controlled drug release, one of the approaches towards addressing these issues involves the use of superabsorbent polyelectrolytes-based nanogels with affinity for both water and organic liquids. Towards the development of biomaterials for the delivery of hydrophobic drugs, in this project, biocompatible, polymerisable Room Temperature Ionic Liquids (RTILs) based on 1-vinylimidazole and amino acids, as well as nanoparticulate co-polymeric gels of the same RTILs and 2-hydroxyethyl methacrylate (HEMA)/1-vinyl-2-pyrrolidone (NVP) with superabsorbency for both water and several organic liquids will be synthesized and characterised. The suitability of the nanogels to be a novel delivery platform for hydrophobic/aqueously unstable drugs will be assessed in vitro in the terms of biocompatibility, drug uploading and release profiles.

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**NBR: 327229** **ACRONYM: TAQUS** **EC FUND: 309235**

**DG:** REA **Call: FP7-PEOPLE-2012-IIF** **Thema:** FP7-PEOPLE-2012-IIF

**Title:** Tailored Quantum Structures

**Abstract:** Self-assembled semiconductor quantum structures are the subject of world-wide interest because of their potential use in quantum information technologies and nanoscale optoelectronics. This project will advance this field by obtaining nanoscale movies of III-V quantum structure formation. This will be achieved by establishing a € 1 million Low Energy Electron Microscope (LEEM) which is the only instrument in the world capable of obtaining nanoscale movies of compound semiconductor growth under arsenic flux. The understanding gained from this work will facilitate a new level of control over specific quantum features for device applications.

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**NBR: 327367** **ACRONYM: CHALQD** **EC FUND: 147210**

**DG:** REA **Call: FP7-PEOPLE-2012-IEF** **Thema:** FP7-PEOPLE-2012-IEF

**Title:** Chalcopyrite Quantum dots for Intermediate band Solar cells

**Abstract:** Solar cells based on today's technology are limited to power conversion efficiency around 30%. To achieve mass deployment of photovoltaic systems there is the need to lower the actual production costs and one way to do so is to produce solar cells with very high efficiencies. Intermediate band solar cells are, in theory, limited to efficiencies as high as 60% and they can be prepared by incorporating quantum dots in a matrix

material. The purpose of this proposal is to prepare intermediate band solar cells based in quantum dots of chalcopyrite materials. Chalcopyrites were chosen because they are known to have good optoelectronic and material properties as demonstrated by their performance when used in thin film solar cells. Solar cells based in chalcopyrites exhibit the highest performance of all the thin film solar cells. To achieve this proposed aim the project is structured in three objectives. The first one is the preparation of chalcopyrite quantum dots using molecular beam epitaxy, the second one deals with the choice and growth of a suitable matrix material and the last one consists in bringing these two parts together and creating a solar cell stack. The candidate has a sound experience in chalcopyrite thin film solar cells and will be trained in the cross-disciplinary areas of preparation, characterization, and theory of nanostructures based in quantum dots. The main objectives are therefore: (1) Development of controlled growth of chalcopyrite-type QDs, and tuning their optoelectronic properties for suitable application in photovoltaic energy conversion (2) Development of a suitable matrix material (3) Tuning the properties of the interface between QDs and matrix to provide the basis for efficient photovoltaic energy conversion. A successful outcome will make significant progress in the knowledge of very high efficiency photovoltaic.

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**NBR: 327446** **ACRONYM: SCM4SCF** **EC FUND: 309235**

**DG:** REA **Call: FP7-PEOPLE-2012-IIF** **Thema:** FP7-PEOPLE-2012-IIF

**Title:** Surface Characterisation and Modelling for Self-Cleaning Function

**Abstract:** Human beings have long tried to learn from and mimic nature. A good example is the successful mimicry, by means of nanotechnology, of the 'lotus leaf effect' in many applications requiring self-cleaning from skyscrapers, machine tools' work surfaces and even to clothes. Surface micro and nano-topography (finish, texture) obviously affects the performance of many engineered and natural systems. The proposed research is aimed at establishing functionally useful correlations between surface micro-geometry and mechanical and tribological properties. It specifically focuses to elucidate the effect of surface features on the local adhesion, friction, hardness and elastic modulus in terms of anti-adhesion and anti-contamination performances. The proposal will bring the joined expertise in both surface measurement and characterisation by Warwick Group and surface modelling by Dr Tian to achieve above ultimate objectives. We will first study the functional surfaces exhibited by engineered and natural systems for their anti-adhesion and anti-contamination performances. Numerical simulation and modelling will be carried out to generate such surfaces with controlled surface parameters, in order to study the effect of surface topography on the contact angle, adhesion and friction and nano-hardness, and the relationships between. Eventually, this will pave a way for scientists and engineers to design an ideal surface structure or topography for a specific function at a low cost. The research will provide benefits for the sponsor by publishing peer reviewed papers and establishing key enabling methodologies for

characterisation and generation of such functional surfaces. The capability of the micro/nano surface measurement and metrology is of high benefit to both UK and European engineers and scientists.

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**NBR: 327540** **ACRONYM: ZHIM** **EC FUND: 221606**

**DG:** REA **Call: FP7-PEOPLE-2012-IIF** **Thema:** FP7-PEOPLE-2012-IIF

**Title:** Organoboron-Based Luminescent Nanomaterials via Crystallization-Driven Self-Assembly

**Abstract:** The scientific objective of this proposal is to incorporate luminescent organoboron functionality into PFS-based block copolymers. In doing so, functional nanostructures will be created by crystallization-driven self-assembly, and their potential applications in nanoscale display technology, bioimaging, and biodiagnostics will be investigated. The exceptionally talented applicant, Dr. Hudson, has extensive experience in organoboron chemistry, luminescent materials chemistry and displays from his Ph.D. in Canada. The Manners group in the UK has well-known internationally-leading expertise in polymer and materials science, block copolymers, and crystallization-driven self-assembly. Thus, the experiences of Dr. Hudson and the Manners group are fully complementary and both are essential for the proposed research to succeed. At the end of the proposed 2 year fellowship period Dr. Hudson aims to return to Canada to a faculty position at a top research-intensive University.

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**NBR: 327563** **ACRONYM: AGAPE** **EC FUND: 166336**

**DG:** REA **Call: FP7-PEOPLE-2012-IIF** **Thema:** FP7-PEOPLE-2012-IIF

**Title:** Avant Garde Approaches to Processable multiscale conjugated polymer hybrid materials with enhanced Electronic properties and water-repellency

**Abstract:** This project aims to circumvent the most severe flaws of Conjugated Polymers (CPs hereafter), namely their processability and stability, while not compromising or even improving their electronic performance. Approaches are presented that will produce performing, water-repellent and processable CPs to feed the emergent Hydrophobic Electronics. A procedure will be developed to allow the CPs grafting on OH-containing nanoparticles profiting of the applicant's knowledge on NHC catalysts, acquired along his 2-year stage at Prof. Navarro's Laboratory in the USA. Nanoparticles are selected to fulfill the double purpose of i) making the solution/suspensions of CPs thixotropic, thus easing processability, and ii) making the final material's surface rough and so water-repellent. These hybrids will be incorporated into a third component (a polymer, solvent or CPs solution) to produce multiscale water repellent CPs, by taking advantage of the

Host Group on surface modification, polymer compounding and superhydrophobicity. This project lies at the interfaces of Polymer Chemistry, Catalysis and Surface Chemistry on one hand, and requires the joint collaboration of Engineering, Chemical Physics and Pure Organic Chemistry. The rare combination of the Applicant's and Host Group's expertise allows to reasonably expecting the successful design of novel materials with exciting new properties

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**NBR: 327706** **ACRONYM: IMAFECY** **EC FUND: 221606**

**DG:** REA **Call: FP7-PEOPLE-2012-IEF** **Thema:** FP7-PEOPLE-2012-IEF

**Title:** Impact of Magnetic Fields on Electrochemistry - Fundamental Aspects and Fututre Applications

**Abstract:** The aim of this project is the fundamental understanding of the various possible impacts of magnetic fields on electrochemical processes. The area has hitherto been plagued with controversy and irreproducibility between different laboratories. The project will resolve these issues, to the ultimate benefit of applied electrochemistry, by novel carefully designed and well-controlled experiments allied to rigorous theoretical modelling. Two analytical methods that enable precise control of the various electrochemical parameters will be applied in presence of magnetic fields for the first time: nanoparticle impact based chronoamperometry and voltammetry in weakly supported electrolytes. Theoretical modelling will enable the applicant to distinguish between individual magnetic field effects and to quantify them. The gained knowledge on fundamentals will be used to set up proof-of-principle experiments demonstrating the benefit of applying magnetic fields in future real world devices. Superior performance of photocatalytic cells and sensor devices shall be demonstrated to emphasise the relevance of magnetoelectrochemistry for future technologies. For the successes of this project the fellowship of the applicant, Dr. Kristina Tschulik, and the scientist in charge, Prof. Richard Compton, is crucial since the first has a strong background in magnetoelectrochemistry, while the latter has unique expertise in analytical and theoretical chemistry and in transferring research results to industrial applications. The host of this fellowship will be the Department of Chemistry at the University of Oxford, which provides all required devices and a modern world-class infrastructure for training of the applicant in a vast variety of scientific and complementary skills.

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**NBR: 327711** **ACRONYM: IMAX** **EC FUND: 175974**

**DG:** REA **Call: FP7-PEOPLE-2012-IEF** **Thema:** FP7-PEOPLE-2012-IEF

**Title:** Improvement of MAterials with X-rays

**Abstract:** Local modifications of materials with X-ray beams have recently been shown feasible by the researcher of this application in exemplary high-Tc superconducting copper oxide materials. These modifications are not based on materials degradation by the creation of structural damage, but rely on ordering of defects such as oxygen vacancies and interstititals, which can even lead to materials improvements, in this case Tc enhancements. These modifications can be realized locally by micro X-ray beams and therefore shapes can be drawn at will in two dimensions when the X-ray beam is used like a pen. The structures could also be erased again by applying heat treatments. Here we propose with the Intra-European Marie Curie Fellowship to join this expertise of the researcher with the various advanced thin film materials science and nanotechnology techniques available at the University of Twente to further explore the potentialities of this X-ray manipulation for relevant nano-materials. Concomitantly, it will provide the researcher with very valuable training in such areas as materials fabrication, advanced microscopy and nanolithography. Selected thin film complex oxides and their heterostructures, e.g.. SrTiO3-LaAlO3 stacks, graphene and chemical derivatives of graphene will be used for the manipulation through the use of X-rays at synchrotron radiation facilities and in laboratory sources. As a special type of structure, we will look at fractal patterns, which were discovered earlier by the researcher to be a route towards a Tc enhancement in the cuprates, and for which also for the electronic transport properties in non-superconducting materials interesting theoretical predictions have been made.

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**NBR: 327726** **ACRONYM: XENO-AUTOANTIBODIES** **EC FUND: 227231**

**DG:** REA **Call: FP7-PEOPLE-2012-IIF** **Thema:** FP7-PEOPLE-2012-IIF

**Title:** Immune Recognition of Xeno-Glycans

**Abstract:** ‘xeno-autoantibodies’ recognize a dietary immunogenic non-self sugar that is metabolized by cells as self and presented on the cell surface. N-acetylneuraminic acid (Neu5Ac) and its hydroxylated form, N-glycolylneuraminic acid (Neu5Gc) are the two major Sia forms in most mammals. Humans are deficient in the enzyme CMP-Neu5Ac hydroxylase (CMAH) that can synthesize Neu5Gc, however dietary Neu5Gc accumulates in epithelial tumors and become immunogenic. Our previous research recognized dual and opposing roles of IgG isotype xeno-autoantibodies in cancer progression, diagnosis and immunotherapy: they facilitate tumor progression via chronic inflammation at low doses, but mediate tumor inhibition at higher doses in a ‘human-like’ Cmah-/- Neu5Gc-deficient mouse model. Furthermore, we developed a novel sialoglycan microarray that lead to the discovery of a specific xeno-auto-IgG that is novel human serum carcinoma biomarker and potential immunotherapeutic. However, our early studies also revealed that some human sera show high levels of anti-Neu5Gc IgAs that could even be affinity-

purified from human serum (7). IgA is the most abundantly produced antibody isotype in the body and the main isotype in mucosal surfaces; It is also present in serum, where IgG is the predominant isotype. I propose a multidisciplinary approach to investigate the biology of IgA xeno-autoantibodies against these unique glycans and their potential involvement in cancer. I will combine glycobiology, immunology, biochemistry, molecular biology, nanotechnology and advanced array techniques to address these lines of investigation both in vitro and in vivo in a relevant mouse model (Cmah-/-).

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**NBR: 328085** **ACRONYM: RPSII** **EC FUND: 221606**

**DG:** REA **Call: FP7-PEOPLE-2012-IIF** **Thema:** FP7-PEOPLE-2012-IIF

**Title:** Re-wiring of photosystem II enzymes to metal-oxide electrodes in artificial photosynthetic devices for enhanced photocatalytic water splitting performance

**Abstract:** Photocatalytic water splitting is an attractive means of efficiently converting solar energy into a storable hydrogen fuel, offering a clean and renewable source of energy that can replace fossil fuel. In this study, the Photosystem II (PSII) enzyme is employed as a biological catalyst in important proof-of-principle studies to establish the basic principles behind emerging artificial photosynthetic devices for efficient light-driven water splitting. Currently, the maximal output of PSII-based photocatalytic water splitting systems is capped by a number of factors, most significantly the non-ideal 'wiring' of the enzymes to the electrode giving rise to inefficient electron transfer. The present Marie Curie International Incoming Fellowship (IIF) project proposes to enhance the performance of benchmark PSII-based photocatalytic systems by 'rewiring' the electron transfer from the bio-catalyst to the anode to eliminate inefficient steps, and hence establish new maximal outputs achievable by such systems. This will be achieved by directed immobilisation of the PSII to the anode, followed by the inhibition of redox events in the electron flow pathway to bypass the rate-limiting step. Moreover, current photocatatlyic water splitting systems rely on expensive rare-earth components which are ultimately non-sustainable and uneconomical for use in future photocatalytic devices. In this study, newly accessible nano-structured earth-abundant substrates will be investigated as electrode material to ultimately encourage the development of more sustainable systems for photocatalytic water splitting.

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**NBR: 328893** **ACRONYM: SINGLE-MOLEC-SWITCH** **EC FUND: 166336**

**DG:** REA **Call: FP7-PEOPLE-2012-IIF** **Thema:** FP7-PEOPLE-2012-IIF

**Title:** Developing single-molecule switches for applications in nanoscale organic devices

**Abstract:** Today, one of the central themes in the Nanoscience is Molecular Electronics which relies on the ability to measure and control electrical current through molecular scaffolds. As in the case of conventional semiconductor electronics that took several decades of research to reach commercial applications, the concept of using few molecules or even a single molecule as active components in electronic devices is now closer to reality. Molecular Electronics research continues in deepening our understanding of the properties of single molecules and is anticipated to lead to novel organic (opto)-electronic devices. However, the question remains "when will this fundamental science turn into a commercial technology?" The answer for this question is "soon". However, this field is still in its infancy and there are several unsolved issues, the most critical one being optimizing molecular contacts with electrodes and controlling current flow through molecular junctions. In this project, we propose to use STM break-junction approaches to measure the properties of single molecules using novel molecular anchoring chemistries to bridge molecules between electrodes. In particular, we intend to integrate newly developed surface chemistry reactions to go a step further in the stability of molecular junctions. Further, we intend to investigate conducting electrodes other than the common gold electrodes because the latter are not ideal for commercial applications. With the opportunity of having robust and low contact-resistance molecule-electrode interfaces, we intend to control the electrical flow through single molecules using electrochemical, light irradiation, solvent and mechanical stress stimuli. This project is hoped to gain fundamental insights into the electrical properties of single molecules, develop novel molecular switches and bring the Molecular Electronics field a step further towards real applications.

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**NBR: 328985** **ACRONYM: COCOPOPS** **EC FUND: 173370**

**DG:** REA **Call: FP7-PEOPLE-2012-IEF** **Thema:** FP7-PEOPLE-2012-IEF

**Title:** The Complimentary Combination of Polyoxometalates and Metal Nanoparticles

**Abstract:** The cooperative chemistry of polyoxometalates (POMs) and metal nanoparticles (NPs) still remains a relatively unexplored area of the chemical sciences despite showing remarkable potential in fields as diverse as catalysis and medicine. The ability to exert synthetic control during the self-assembly of any nanostructured material constructed from molecular precursors is of fundamental importance for its application as new material or device. In recent years, zero-valent state plasmonic noble-metal NPs have received a remarkable amount of attention due to their distinctive chemical, physical and optical properties. Efficient synthetic protocols are therefore required in order to reliably access a range of NP shapes, sizes and elemental compositions in high yield with minimal cost and toxicity. One emerging approach involves the use of POMs as reducing, capping, and stabilising agents. Dr. Scott G. Mitchell (the applicant) will develop new research skills by partnering him with Dr. Jesús Martínez de la Fuente and an internationally recognised group of nanotechnologists: The Nanotherapy and

Nanodiagnostics group (GN2) at the Institute of Nanoscience of Aragón (INA) at the University of Zaragoza. The proposed research combines POMs and metal NPs as nanohybrid materials possessing responsive and switchable properties that are tuneable on the nanoscale. This two-year project will train the applicant in essential areas of microscopy as he generates novel materials which will be not merely of academic interest, but could have a number of real world applications in medicinal devices, materials science and catalysis. This next step in Dr Mitchell's career is crucial in determining his long-term development; therefore the proposed work builds on existing skills developed during his PhD and postdoctoral research and develops completely new areas of research in inorganic chemistry and nanotechnology, acting as an ideal springboard for the applicant's subsequent career.

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**NBR: 329575** **ACRONYM: MARAGNANO** **EC FUND: 221606**

**DG:** REA **Call: FP7-PEOPLE-2012-IEF** **Thema:** FP7-PEOPLE-2012-IEF

**Title:** The behaviour, fate and ecotoxicological effects of silver nanoparticles in estuarine and coastal waters

**Abstract:** The overall aim of this project is to establish the behaviour, fate and ecotoxicological effects of silver nanoparticles (AgNPs) in estuarine and coastal waters. Silver is a toxic element and increasingly used in NPs added to consumer products. This is resulting in AgNP release to marine waters. There is a lack of knowledge on AgNPs in marine systems, hampering development of legislation. The project has the following specific objectives: 1.Manufacture AgNPs with different core sizes and coatings and establish their dissolution, surface properties and behaviour under different environmental conditions: Ag salts will be used to manufacture AgNPs and stable isotope 109AgNPs by chemical reduction using selected chemical agents 2.Determine speciation of AgNPs in seawaters: Experiments will be conducted by spiking solutions with manufactured AgNPs of different chemical characteristics to study Ag ion release, kinetics of AgNP dissolution, solubility, shape and size changes of AgNPs. Furthermore, we will determine the concentration of AgNPs present in estuarine and coastal waters 3.Study the toxic effects of AgNPs on marine organisms: We will undertake toxicological studies using phytoplankton and oyster embryo larvae. Experiments will be carried out by varying the AgNPs dose, exposure time and toxicological media. 4.Establish a model of behaviour and fate of AgNPs in marine environments: The obtained data will be used for the development of mathematical models aimed to model the residence times, dynamic concentration profiles and aggregate size distributions of AgNPs in seawaters The obtained results will address vital questions: Are AgNPs already present in EU seawaters? Can AgNPs be bioavailable in marine ecosystems? What is their speciation and toxicity in marine waters? Can a model describe the fate and behaviour of AgNPs in solution? We will communicate the outcomes of this project to the scientific community, the wider public, and also to policy makers (CEFAS, UK)

**NBR: 330076** **ACRONYM: QUANTUM QUENCH** **EC FUND: 144177**

**DG:** REA **Call: FP7-PEOPLE-2012-IIF** **Thema:** FP7-PEOPLE-2012-IIF

**Title:** Universality in the Non-Equilibrium Dynamics of Strongly Correlated Quantum Systems

**Abstract:** Compared to our understanding of equilibrium physics, the study of out of equilibrium dynamical phenomena is still in its infancy. Equilibrium systems can often be understood using mean field theory, universality and renormalisation group techniques. The situation is different away from equilibrium: there are fewer theoretical tools available, new approaches have to be developed and new organising principles have to be found. In recent years out of equilibrium systems have become the subject of intensive research. The huge interest in the issues of thermalisation was partly triggered by the enormous progress of experiments in atomic physics, quantum optics and nanoscience. The possibility of realising simple models in a controlled and tunable fashion opens up the way to explore new frontiers, including non-equilibrium dynamics. In the cold atom experiments the system is almost perfectly isolated from its environment, which allows for the study of relaxation of closed systems and coherent quantum dynamics. Understanding these matters can be relevant for future precision measurement devices and quantum computation as well as for the dynamics of the early universe or the heavy ion collisions. The question whether and how closed systems thermalise is deeply connected with the foundations of statistical physics. Does the system reach a steady state? How can this state be characterised? Is it thermal? What is the role of the size, dimensionality and integrability of the system? Most importantly, what are the universal features of the nonequilibrium dynamics? The research project aims to investigate these questions for strongly correlated quantum field theories. First individual systems will be carefully analysed using a very flexible numerical method, the Truncated Conformal Space Approach. Then the main goal is to develop a general theoretical framework, a dynamical renormalisation group that captures the universal aspects of the time evolution and the steady state.

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**NBR: 330524** **ACRONYM: IQDOTPV** **EC FUND: 192622**

**DG:** REA **Call: FP7-PEOPLE-2012-IIF** **Thema:** FP7-PEOPLE-2012-IIF

**Title:** All-Inorganic Quantum Dot Films for Photovoltaic Applications

**Abstract:** Great progress has been achieved over the last 20 years in the colloidal synthesis of semiconductor, metallic, and magnetic nanocrystals (NCs). The state-of-the-art synthetic approaches allow obtaining inorganic nanostructures with high degree of crystallinity

and precisely engineered compositions, sizes, and morphologies, while solubility in nonpolar solvents provides remarkable processability of colloidal nanomaterials. In the present time, research efforts are largely focused on the implementation of colloidal nanocrystals in a broad spectrum of electronic and optoelectronic devices. Highly promising is the use of colloidal semiconductor nanocrystals (also known as colloidal quantum dots, QDs) in solar cells with the theoretical potential to overcome the Shockley–Queisser limit of 31-41% power efficiency for single bandgap solar cells. Recently, Sargent et.al. have shown that electronic properties of colloidal NC films currently limit performance of nanocrystal-based solar cells. Efficiency of the carriers' transport through NCs in the NC solid strongly depends on NC environment. However, NCs prepared by traditional colloidal techniques are capped with long-chain hydrocarbon ligands ("organic capping") introducing insulating layers around each NC. Significantly improved charge transport has been achieved by using shorter organic linking molecules or by partial removal of ligands by hydrazine treatment. Yet small and volatile organic molecules cause instabilities in solid state devices. Recently, an important breakthrough has been made through the use of small and chemically simple inorganic ligands such as discovery of metal-chalcogenide complexes and metal-free inorganic ligands. The goal of this project is to design inorganic surrounding for colloidal nanocrystals that will lead to semiconductor NC solids with predictable optoelectronic characteristics and eventually to novel absorber layers for all-inorganic, stable and efficient solar cells.

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**NBR: 330886** **ACRONYM: FLUMABUD** **EC FUND: 202405**

**DG:** REA **Call: FP7-PEOPLE-2012-IEF** **Thema:** FP7-PEOPLE-2012-IEF

**Title:** The role of the influenza virus matrix protein M1 in budding adn virus release

**Abstract:** Enveloped viruses, such as influenza, acquire their outer lipid envelope by budding from the membrane of the infected host before being released in the extra-cellular space by membrane fission. In these last steps of the virus infection cycle, matrix proteins connecting capsid with the lipid envelope often play a key role in assembly and budding of newly produced virions. In spite of the widely acknowledged impact on public health and economy of influenza epidemics, the processes facilitating egression of the flu virus are only poorly understood. The goal of this project is to investigate the mechanisms by which Influenza escapes from its host. We will, in particular, focus on the role of its matrix protein M1. Our approach is based on the use of a combination of minimal cell membrane models produced in vitro upon self-assembly of lipids. Using supported lipid bilayers (SLB), giant unilamellar vesicles (GUV), as well as membrane nanotubes of compositions reflecting those of the host´s plasma membrane, we will provide a physical understanding to the role of M1 in facilitating virus assembly into a bud and release from the host. Through our study, we will elucidate whether M1 can promote budding and fission via scaffolding and whether the formation of lipid microdomains can help

overcoming the energy barrier required for membrane abscission. Once the system is established, it will be extended to mimic the role the riboneucleoproteins core (RNPs), using nanoparticles of geometries similar to the viral capsid. Furthermore, the contribution of other viral components will be taken into consideration. In particular, we will look for a synergy between M1 and the ion channel M2 as the latter is believed to be involved in fission. A detailed understanding of the individual steps of the viruse's life cycle is not only interesting from a fundamental point of view but is likely to greatly benefit to the development of more efficient antiviral drugs and treatments.

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**NBR: 331184** **ACRONYM: BENGRAS** **EC FUND: 177000**

**DG:** REA **Call: FP7-PEOPLE-2012-IIF** **Thema:** FP7-PEOPLE-2012-IIF

**Title:** Bandgap engineering of graphene by molecular self-assembly

**Abstract:** BENGRAS is a Marie Curie IIF project that focuses on multidisciplinary transfer of knowledge from a promising Australian early career researcher to KU Leuven towards the design and synthesis of novel functional nano-materials and the development of advanced analytical techniques for material analysis. The project will study bandgap engineering in graphene induced by physi- and chemi- sorption of self-assembled molecular monolayers, which is an interdisciplinary research topic centered at the interface between materials science, supramolecular chemistry, nanoscience and physics. Graphene, a material consisting of flat one-atom-thick sheets of carbon atoms has enormous potential for the use in electronic transistors because of the unique electronic properties and the reduced dimensionality. Graphene is a 'zero-gap' semiconductor and to unlock its electronic properties two basic requirements must be satisfied. Firstly, precise control over electronic band structure (bandgap) is needed. This can be achieved by adsorbing atoms and molecules (e.g. H, OH, K, NH3) on its surface thus generating local mid-gap states. Secondly, the means to control the degree of ordering and periodicity of modified graphene layers are to be derived. In other words, the regions where bandgap can be locally tuned have to be extended to a micron scale for practical applications. At present, this issue remains largely unexplored. This project will investigate the electronic structure of graphene the surface of which has been nano-patterned by physisorped (i.e. weak surface interactions) and covalent (i.e. strong surface interactions) molecular monolayers. Through BENGRAS the fellow will contribute extensive expertise in carbonaceous materials and spectroscopy towards controlled modification of electronic properties of graphene and, designing appropriate analytical methods for the study of low-dimensional materials using optical spectroscopy methods at the nanoscale.

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**NBR: 331281** **ACRONYM: NP-DNA-NDDS** **EC FUND: 309235**

**DG:** REA **Call: FP7-PEOPLE-2012-IIF** **Thema:** FP7-PEOPLE-2012-IIF

**Title:** Multifunctional theranostic nanoparticles using pH-responsive DNA-nanoparticle conjugate for effective cancer therapy

**Abstract:** Cancer is a leading cause of death worldwide, accounting for 7.6 million deaths in 2008. Although conventional cancer chemotherapy can provide profound benefits, seriously adverse side-effects still cannot be avoided, due to lack of specific targeting nature of current treatments. Nanomedicine can reduce such side-effects by exploiting characteristic properties of tumors for targeted delivery and therapy. Despite extensive research, most nanomedicines developed so far have relied on passive targeting using a single therapeutic modality, which are inefficient for treatment of challenging conditions such as multi-drug resistance. Recently we developed a pH-responsive-DNA-GNP conjugate based nanocarrier that numerous features required for an ideal drug nanocarrier, e.g. uniform small nanoscale size, resisting non-specific adsorption, non-toxic, biocompatible, water-soluble, stable, and having high drug loading and controlled release capacities. It can offer efficient and pH-triggered drug release suitable for effective cancer chemotherapy at the cellular level using doxorubicin, a widely used chemotherapy drug. Herein we will extend it into a more effective, multifunctional nanomedicine that can offer simultaneous biomodal chemotherapies with hyperthermia and MRI imaging capacities. First, we will prepare, characterize, and evaluate their drug loading & release profiles in buffer; then we will study and quantify their cell- & cell-specific- uptake and drug delivery efficiency, and then evaluate their toxicity, cytotoxicity & cell-specific cytotoxicity with cancer cells (incoming phase), and finally evaluate their synergistic therapeutic efficacy at cellular and preclinical level (re-integration phase). This project will greatly benefit both the fundamental research in nanomedicine and the healthcare/pharmaceutical indurstries in Europe.

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**NBR: 331330** **ACRONYM: POLYBRUSH** **EC FUND: 161968**

**DG:** REA **Call: FP7-PEOPLE-2012-IEF** **Thema:** FP7-PEOPLE-2012-IEF

**Title:** Dynamics in polymer brush-nanoparticle systems

**Abstract:** Polymer brushes are long polymer chains tethered to a surface by one end. They have applications in chemistry, engineering, medicine, microelectronics, etc. Many of these applications involve interactions between the brush and nanoparticles which are near or within the brush (for instance, when used to arrest toxic substances or to arrange nanoparticles in the patterned surface). Structure of these composite brush-nanoparticle systems has been largely studied but only a few works have been carried out concerning their dynamics. To be able to design the systems for the applications efficiently, a good understanding of their dynamics is essential. This project aims to

provide a comprehensive description of the dynamic behaviour of brush-nanoparticle systems as a function of key parameters such as nanoparticle size, concentration, and penetration depth, polymer chain molecular weight, and grafting density. Gold nanoparticles within PDMAEMA brushes will be used as model systems and the different samples characterized using small angle x-ray scattering (SAXS), ultraviolet-visible spectroscopy (UV-Vis), atomic force microscopy (AFM), ellipsometry, x-ray reflectometry (XRR), and neutron reflectometry (NR). Thereafter, long- and short-time dynamics of brush and nanoparticles will be measured using the more recently developed techniques of evanescent wave dynamic light scattering (EWDLS), resonance enhanced dynamic light scattering (REDLS), and neutron spin echo under grazing incidence (GINSE). This will allow to gain insight into particle-polymer brush interactions which will foster development of models that can be used to optimize current applications or even originate new ones.

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**NBR: 331416** **ACRONYM: NANOQUENCH** **EC FUND: 166336**

**DG:** REA **Call: FP7-PEOPLE-2012-IEF** **Thema:** FP7-PEOPLE-2012-IEF

**Title:** Novel coatings to prevent biofilm formation on urinary catheters based on nanoantibiotics and quorum quenching compounds

**Abstract:** NanoQuench project is about the development of alternative methods to coat indewelling medical devices to control microbial biofilms with relevance to clinical drug resistance. Biofilms are bacterial communities embedded in a self-produced polymeric matrix that commonly grow on indwelling medical devices, such as catheters. This mode of growing is believed to be regulated by a quorum-sensing (QS) system, a unique mechanism of communication that bacterial cells use through the secretion and uptake of small hormone-like molecules, called autoinducers. Due to their innate resistance to the immune system and low susceptibility to antibiotics, the microbial biofilms are difficult to treat and are a major factor in the morbidity and mortality of most infectious diseases. Methods by which the initial stages of bacterial attachment and biofilm formation can be restricted or prevented are therefore needed. Technologies that avoid catheter biofilm formation are based mainly on the application of conventional antimicrobial agents. However, the high resistance of bacteria within the biofilm makes any single therapeutic intervention unlikely to have sufficient effect. This project focuses on the development of an integrated technological platform comprising quorum quenching enzymes and novel antibacterial agents (nanoantibiotics), able to counteract biofilm formation and at the same time avoid development of bacterial resistance to the therapy. These functional compounds will be coated onto catheters via layer-by-layer technique or a novel ultrasonic process.

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**NBR: 331460** **ACRONYM: NANOART** **EC FUND: 166336**

**DG:** REA **Call: FP7-PEOPLE-2012-IEF** **Thema:** FP7-PEOPLE-2012-IEF

**Title:** Nano Art Research Tool

**Abstract:** "Our ordinary language has no means for describing a particular shade of colour" (Ludwig Wittgenstein in Philosophical Remarks, Chicago: The University of Chicago Press, 1984). This interdisciplinary project, combining Conservation Science, Nanotechnology, Restoration and Art History, aims to confront this problem regarding the binders applied in paintings, sculptures and illuminated manuscripts, which have a particularly diverse colour palette, rich in material terms as well as in symbolic and aesthetic values. Currently, the characterization of artwork binders (egg yolk, glair, gums and oils) requires microsampling combined with powerful but expensive techniques performed by specialized personnel. Despite all the advantages that nanotechnology has brought to molecular diagnostics and the healthcare industry in the recent years, the field of artwork preservation and conservation has not yet greatly benefited from nanobiosensing tools. The NANOART project will develop a nanobiosensor for the successful detection and identification of the biomolecules present in the paints of ancient artworks. This will lead to the development of a new and inexpensive "nanokit" based on gold nanoparticles which will allow to identify at point-of-care the nature of binders used in different artworks with an enhanced sensitivity. The gold nanoparticles will be used as a reporting agent enabling a colorimetric identification of different biomarkers that may be present in nanosamples taken from artworks, providing a unique opportunity to immediately explore the origin of the binders at the naked eye. The NANOART kit will hopefully be made available to conservation scientists from around the world, facilitating the knowledge over historical productions and help worldwide museums, conservation and restoration art studios and laboratories to plan the best conservation and preventive strategies for our worldwide Cultural Heritage.

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**NBR: 331476** **ACRONYM: LICRYSTG** **EC FUND: 223778**

**DG:** REA **Call: FP7-PEOPLE-2012-IIF** **Thema:** FP7-PEOPLE-2012-IIF

**Title:** Single-crystalline Lithium-based model systems of future materials for electrochemical energy storage and data storage

**Abstract:** Li-based olivine phosphates exhibit an enormous potential for applications such as next-generation cathode materials for Lithium-ion batteries and for faster and more reliable data storage devices. A fundamental understanding of this extremely promising class of materials however demands single-crystals which allow to study intrinsic material properties and the interactions between intrinsic electronic and structural properties on

the one hand and kinetics, domain effects and electrochemical performance on the other hand. The aim of the proposal is hence to synthesize and to investigate high quality single crystals of these materials for studying (1) anisotropic parameters relevant for applications in Lithium-ion batteries for different crystal directions, and (2) the ferrotoroidicity of the grown crystals for potential applications in data storage. In order to achieve this aim, a unique high-pressure traveling-solvent floating zone furnace will be applied which allows single crystal growth of Li-based systems under external pressure of 150 bar. The outcome will be the growth of hitherto and with conventional methods not accessible high-quality single crystals with large sizes, quantitative information about relevant intrinsic materials parameters such as anisotropic electronic conductivity and Li diffusion, and proper understanding of the ferrotoroidal properties in Li-based olivine phosphates. The main experimental work will be performed at U Heidelberg and ETH Zürich. The project results will yield valuable information for optimizing and tailoring nano- and microstructured Li-ion battery materials as well as on the potential of ferrotoroidicity for data storage, thereby providing an opportunity to European industry in cutting-edge technologies.

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**NBR: 331703** **ACRONYM: NANOMECHAMYLOID** **EC FUND: 282561**

**DG:** REA **Call: FP7-PEOPLE-2012-IOF** **Thema:** FP7-PEOPLE-2012-IOF

**Title:** Investigation of the relationship between the material properties of insoluble, protein aggregates known as amyloids and common forms of age-related dementia such as Alzheimerâ€™s and Parkinsonâ€™s.

**Abstract:** The conversion of normally soluble and functional proteins into insoluble protein aggregates known as amyloids are linked to more than 50 human disorders, including several common forms of age-related dementia such as Alzheimer's and Parkinson's diseases. Amyloids exist as long, rope-like structures known as fibrils which can self-associate into intractable plaques-a hallmark of many amyloid-related diseases. Here we propose to investigate the potential role the material properties of amyloid, in particular their rigidity and propensity to break, play in both the pathology and transmission of amyloid-related disorders. We propose to study the material properties of amyloid using a new and ground-breaking form of microcopy known as 4D ultrafast electron microscopy (UEM). This unique microscope combines the spatial resolution of electron microscopy (nanometer) with the temporal resolution of laser spectroscopy (femtoseconds) and can directly apply minute (piconewton) forces to materials, making atomic-scale "movies" of the resulting displacements. This sets it apart as the technique of choice for characterizing the stiffness and fracture mechanics of proteinaceous nanofibrils such as amyloid. Using this revolutionary technique, we hope to determine the stiffness of amyloids, use amyloid as a single molecule biosensor, perform optical trapping experiments on individual Alzheimer's disease-related fibrils within the column of an electron microscope and study the destruction of cataract-related amyloid

plaques. These results will provide us with some fascinating insights into the molecular forces governing the behavior of amyloids and how this may relate to their pathology in living organisms.

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**NBR: 332045** **ACRONYM: RIGIDITY SENSING** **EC FUND: 264711**

**DG:** REA **Call: FP7-PEOPLE-2012-IOF** **Thema:** FP7-PEOPLE-2012-IOF

**Title:** Mechanisms of Cellular Rigidity Sensing

**Abstract:** Recent studies show that the rigidity of the extracellular matrix is a critical determinant of cell growth, differentiation, and death. Cells sense rigidity via integrin adhesions and respond by changing their morphology, signaling, and gene expression patterns. Irregular rigidity signals or defective responses to appropriate rigidity signals underlie many medical disorders. This is especially evident in cancer, where the ability of cells to detect differences in matrix rigidity is fundamentally altered. Despite the importance of mechanosensing of matrix rigidity, findings in this field have been mainly phenomenological, and at the moment we still don't know how rigidity sensing occurs. Active rigidity sensing involves development of traction forces on integrin adhesions, yet how cells develop forces, and how these forces are used to sense and transmit rigidity signals are both unknown. This grant is focused on analyses of the steps in building the machinery used by fibroblasts to sense and transmit rigidity signals. During the outgoing phase of the studies the applicant will use a combination of nanofabricated surfaces with integrin ligands, elastic micropillars that allow measuring forces, and super-resolution microscopy to define the critical steps in the assembly of integrin adhesions and to determine which proteins are essential for force production. The return phase of the studies will focus on investigating the signaling events downstream of rigidity sensing using biophysical measurements of the interaction kinetics of signaling molecules with integrin adhesions. The proposed studies will provide a detailed spatiotemporal description of the critical components and pathways of mechanosensing of matrix rigidity, and will help explain the underlying mechanisms involved in rigidity sensing during important processes such as differentiation or cancer.

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**NBR: 332078** **ACRONYM: GUVS-3G** **EC FUND: 254925**

**DG:** REA **Call: FP7-PEOPLE-2012-IOF** **Thema:** FP7-PEOPLE-2012-IOF

**Title:** Smart photo-activable devices based in plasmonic nanoparticles: Microfluidic-assisted engineering of a third generation of lipid vesicles

**Abstract:** Giant lipid vesicles can be potentially used as biocompatible carriers with a large lumen cavity adequate for lodging large biomacromolecules in an aqueous compartment. New developments in controlled delivery are strongly troubled by the high polydispersity of the preparations and the limitations in the encapsulation abilities inherent to conventional preparative methods. Engineering smart vesicles with tunable and remotely controllable properties such as permeability, osmotic deformability or inducible instability, necessary for adequate delivery, is indeed a major synthetic challenge. This implies a number of basic operations, which include bilayer assembly, composite membrane stabilization, encapsulation and compartmentalization, a set of procedures requiring a novel approach. For this performance, we propose the use of microfluidic technology and high-speed imagining to design and study the active response to photo-irradiation of smart giant unilamellar lipid vesicles with plasmonic gold nanoparticles embedded in the membrane. Excitation of the surface plasmons of the nanoparticles produces localized heating of the membrane, thus controllable changes in permeability, which could eventually result in an enhanced osmotic-driven flow of solvent across the membrane and cause an overall change in size and shape of the entire vesicle. Using these model systems we will be able to shed light on the physical mechanisms involved in the transference of conformational- to mechanical-energy, which could be relevant to a broad range of scientific problems ranging from the fundamental knowledge in cell biology, concerned by the study of cellular functions such as endo- and exocytosis and cell motility, to applications in drug delivery and material engineering, both enrolled in the development of hybrid materials able to exert nastic motions inducible by external stimuli.

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**NBR: 333799** **ACRONYM: NANOMAG-SQ** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2012-CIG** **Thema:** FP7-PEOPLE-2012-CIG

**Title:** Magnetic imaging of individual nanomagnets

**Abstract:** Magnetic nanoparticles have a number of present and proposed applications in biology and medicine, such as bio-separation, drug delivery, magnetic resonance imaging and hyperthermia cancer treatment, as well as important role in future high density data storage and spintronic devices. Therefore, there is high interest and strong need to characterize them properly. So far the common characterization method has been to measure a large number of them together in order to accumulate sufficient signal. This is problematic because the magnetic properties of nanomagnets are inherently sensitive to small variations in volume, shape and structure, and this strong variability is averaged in the bulk. It is therefore vital to characterize nanomagnets individually. Successful experiments are rare and required extensive efforts to characterize one single particle. I propose to use a scanning SQUID with sufficient sensitivity and spatial resolution to detect an individual nanomagnet and use the scanning capability to sample many individuals to gain statistics about the variability of their physical properties. In addition

to establishing a breakthrough characterization tool, I plan to address physical questions of interest such as the nature of the interactions between small numbers of particles, the dynamics of these particles and the distribution of physical properties. To accomplish this we need an extremely high moment sensitivity, sufficient spatial resolution, minimal magnetic influence of the probe on the particle, and access to various temperatures. These requirements point to the SQUID as an ideal candidate for this task. In the framework of this grant I plan to investigate two types of nanomagnets: FePt particles, which are candidates for biomedical applications; and CoFe dots fabricated on multiferroic materials for electric-field control of local ferromagnetism. The latter is of high interest for memory and logic device applications.

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**NBR: 333821** **ACRONYM: ACTIVE NEC** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2012-CIG** **Thema:** FP7-PEOPLE-2012-CIG

**Title:** Active Nanoantenna-Exciton-Complexes

**Abstract:** The interaction between light and matter by creation of excitons (electron-hole pairs) provides one of the most common routes for generation of functional optical and electro-optical devices. These devices including lasers, detectors, biological markers, solar cells, etc., have great impact both on science, technology, and common wellbeing. In order to make better optical and electro-optical devices, i.e. more efficient, smaller and faster, it is highly important to find new and improved ways to focus, control, and couple light to optically active materials. One promising way to achieve it is by utilizing extreme plasmonic field enhancements on optical nanoantennas which have a dramatic effect on light-matter interaction. Here I propose to study experimentally and theoretically the use of advanced arrangements of optical nanoantennas that support extreme field enhancements to boost the interaction between light and excitons in nanoantenna-exciton-complexes (NECs). The first aim of this project is to use NECs to generate exciton-localized-surface-plasmon-polaritons (XLSP) operating at the strong and ultrastrong coupling regimes and to probe the intriguing associated physical phenomena. The second aim is to create novel ultrafast all-optical switches of XLSPs and to use them in different device applications. The third aim is to study for the first time stimulated scattering effects of XLSP and to demonstrate Bose-Einstein condensation of XLSPs in optical nanoantenna trap. The fourth aim is to combine the field of plasmonics with the emerging field of photon upconversion by sensitized triplet-triplet annihilation and to create NECs that support plasmon upconversion. This will lead to improvements of photon upconversion techniques and open door to new nanoscale energy converting devices. For the studies we will use advanced nanofabrication techniques and advanced experimental methods, including ultrafast probe beams, lifetime imaging techniques and near field nanoscopy.

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**NBR: 333843** **ACRONYM: INTERSTRUCFRICNANO** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2012-CIG** **Thema:** FP7-PEOPLE-2012-CIG

**Title:** Investigating the Effect of Interface Structure on Friction at the Nanoscale

**Abstract:** The physical phenomenon of friction is the main source of energy "loss" in a number of technical applications and industrial processes. Despite this fact, which holds significant economic importance, a complete understanding of fundamental physical principles governing frictional processes is still lacking. Considering that an ability to predict and control macroscopic friction depends on accurate investigations of friction at the nanometer scale, the research area of nanotribology –the science of friction, lubrication and wear at the nanoscale– has been established about 25 years ago. The main scientific tool that spearheaded developments in this field, the friction force microscope (FFM), provided researchers with a great deal of insight regarding frictional properties of nanoscale "single-asperity contacts" on different substrates as a function of various experimental parameters. Despite this success, many open questions remain regarding friction at the nanoscale, due to inherent limitations of the single-asperity FFM technique in terms of contact area, choice of materials, and poorly-characterized interface structures. Being motivated by recent developments in the field, we propose in this grant application to investigate the frictional properties of structurally well-defined, crystalline gold "nanoislands" on a number of substrates such as graphite and graphene using commercially available atomic force microscopes, as a function of island size, shape and crystallographic direction of motion. Additionally, we propose to use nanoislands made from bulk metallic glass (BMG) in amorphous and crystalline form, to test the influence of interface crystallinity on friction at the nanoscale. It is expected that the 4-year research plan described in this proposal will contribute significantly to the understanding of structure-friction relationships at the nanoscale, bringing the scientific community closer to a complete physical picture of the fundamentals of friction.

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**NBR: 334030** **ACRONYM: SALMOVIR** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2012-CIG** **Thema:** FP7-PEOPLE-2012-CIG

**Title:** Molecular mechanisms of bacterial motility and type-III secretion in virulence of Salmonella

**Abstract:** Salmonella are motile, gram-negative, pathogens that infect eukaryotic cells. Outbreaks of salmonellosis are a great economic and health problem worldwide. Many bacteria, like Salmonella, swim through liquid environments by rotating a helical organelle, the flagellum. This sophisticated nanomachine is functionally and structurally related to virulence-associated type-III secretion systems (T3SS) of pathogenic bacteria. The ability

to move is of crucial importance for Salmonella virulence and infection of eukaryotic cells. Although the importance of bacterial motility and T3S in virulence of Salmonella is established, a detailed understanding of the expression and molecular interplay between the flagellar and virulence systems during infection is missing. The aim of this research program is to study the mechanisms of bacterial motility during bacteria-host interactions and the molecular function of T3SS using an unique combination of sophisticated bacterial genetics, microscopy, biochemistry and infection biology techniques. Both flagellar motility and the process of T3S are essential for virulence and represent attractive targets for novel anti-microbial agents. Therefore, I will analyze the general importance of flagella and bacterial motility during the Salmonella infection process (Aim 1). In complementary projects, I will focus on the molecular mechanisms of bacterial T3SS like the mechanism of substrate translocation (Aim 2), and screen for compounds that inhibit T3SS (Aim 3). The proposed research program will provide novel and fundamental insights into our understanding of the molecular details of Salmonella virulence. Thereby, the initial events required for the commitment of the bacteria to invasive diseases could become clear. Importantly, this knowledge could be used to design specific inhibitors of bacterial T3SS, which might have the potential for new anti-bacterial agents that are urgently needed at a time when antibiotic resistance is increasing.

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**NBR: 334069** **ACRONYM: NANOSURF** **EC FUND: 87500**

**DG:** REA **Call: FP7-PEOPLE-2012-CIG** **Thema:** FP7-PEOPLE-2012-CIG

**Title:** Surface Energetics of Low Dimensional Nanostructures

**Abstract:** This proposal aims to probe the surface energetics of low dimensional nanomaterials (LDNs). Materials on this scale show immense promise (mechanically, electrically, thermally, etc.) but to realise this potential they must first overcome their tendency to aggregate. Measuring and understanding the surface energy of such nanomaterials is of vital importance if one wishes to produce solutions of exfoliated LDNs and thus harness their full potential in composites, or devices. At present, there is a lack of information on the surface energetics of materials such as carbon nanotubes, graphene and other novel LDNs. Experimental and computed values vary dramatically due to a lack of reliable methods to measure surface energy and the difficulty in producing a representative sample to measure. In this proposal, I will use inverse gas chromatography (IGC) to accurately measure the surface energy of a range of LDNs. Recent advances in this technique (of which, I have had close involvement) and my expertise at exfoliating nanomaterials to make representative samples (including a 2011 Science publication) make this proposal timely and offers the potential for field-leading research in this area to be conducted. I have outlined a clear objective-based work plan fully supported by the school of physics and CRANN (both at Trinity College Dublin) to achieve my research goals. As well as using IGC to probe the surface energy of LDNs, this proposal aims to i)

determine the role of graphene edges in the liquid phase exfoliation of graphite, ii) determine the dependence of graphene surface energy with flake size, iv) control the surface energy of 2-D nanosheets (such as transition metal dichalcogenides) by edge functionalisation to create novel hetro-structures, v) tailor the surface energy of nanomaterials such as graphene and nanotubes through functionalisation to create smart composites. Each research objective will answer fundamental questions pertaining to such nanomaterials.

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**NBR: 334134** **ACRONYM: NANOTRAC** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2012-CIG** **Thema:** FP7-PEOPLE-2012-CIG

**Title:** Tracing the Intracellular Fate of Anticancer Nanomedicines

**Abstract:** Nanomedicines are defined as specifically engineered, nanosized drugs and drug delivery systems that are comprised of multiple components. For example, polymer-drug conjugates and drug-protein conjugates are emerging as promising approaches to treating a number of diseases, including cancer. The payloads of these nanomedicines differ widely. However, when targeting cancer, there is a universal requirement to reach the tumour microenvironment and often to deliver the payload to a specific intracellular compartment in order to yield the desired therapeutic effect. The goal of this proposal is to develop two complementary approaches that showcase the manufacturing of functionalised biopolymer-based nanoparticles and their subsequent biological evaluation in relation to cellular and subcellular trafficking in the tumour microenvironment. To achieve this goal, I propose two main aims. Aim 1 is to generate drug-loaded silk nanoparticles that can be readily functionlised to target specific cells and cellular compartments. I hypothesise that by using functionalised silk nanoparticles, it will be possible to target and deliver a therapeutic payload to cancer cells, which will lead to improved clinical outcomes in vivo. Aim 2 is to establish a repertoire of subcellular fractionation techniques in order to quantitatively describe the intracellular fate of nanomedicines in vitro and in vivo. I hypothesise that in particular, subcellular fractionation methods will allow a better understating of the fate of nanoparticles in tumour cells and their subsequent intracellular trafficking. Taken together, these studies will demonstrate an integrated approach to the development of next-generation nanomedicines. This proposal provides the drug delivery field with a novel nanoparticle system and a unique toolbox for the cellular tracing of nanomedicines for the wider scientific community.

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**NBR: 334463** **ACRONYM: ULTRAQUEST** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2012-CIG** **Thema:** FP7-PEOPLE-2012-CIG

**Title:** Ultrafast quantum transport in nanosystems controlled via phase-locked single cycles of light

**Abstract:** The aim of the project consists in starting new experiments in which the absolute optical phase of quasi single-cycle light pulses is harnessed to directly control charge transport in quantum nanosystems. The basic concept of this technique relies on the fact that, with ultrashort pulsed laser sources, it is possible to obtain extremely high peak intensities and thus high peak electric fields. Such pulses can be focused on a nano-scale junction of an electronic circuit. The strong field then allows symmetry breaking of the electronic band structure and triggers charge tunneling from one side of the junction to the other one through the potential barrier of the dielectric medium. Since this effect depends nonlinearly on the bias field, a net current results in the limit of phase-locked excitation pulses thus giving rise to temporal resolution and control on the sub-cycle timescale. In this project we want to exploit the described phenomenon in a regime in which it would be possible to study ultrafast electron transport in nanosystems with strong quantum confinement. To this end, we plan to fabricate nanostructured plasmonic junctions in patterned circuits loaded with single quantum systems such as semiconductor quantum dots. To study the quantum charge transport on such systems we need extremely high sensitivities and a control of the current down to a single electron per pulse. In addition, it is extremely important that the pulse that triggers the quantum tunneling of the charges is far from any resonant optical excitation. For these reasons, we will develop a phase-locked Er:fiber laser source equipped with Tm: and Yb:fiber amplifying stages that will be able to generate single optical cycle optical pulses at wavelenghts around 2 microns. We envision that the study of the ultrafast quantum charge transport on samples positioned in the nano-junction will open new exciting parameter ranges and phenomena related to charge transport in quantum systems.

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**NBR: 334584** **ACRONYM: NANOTUBEQUBIT** **EC FUND: 100000**

**DG:** REA **Call: FP7-PEOPLE-2012-CIG** **Thema:** FP7-PEOPLE-2012-CIG

**Title:** A quantum computer based on electron spins in carbon nanomaterials

**Abstract:** I will create a two-qubit universal quantum computer based on electron spins a carbon nanotube. Nanotubes are outstanding host material for spin qubits, because they allow hyperfine decoherence to be completely eliminated. Very recently, I demonstrated the first single qubit in a nanotube, using electric fields combined with a bend in the nanotube to coherently control an electron's spin. This project will realize the additional elements for a computer: high-fidelity qubit readout, a two-qubit gate, and long-lived quantum memory. The objectives are threefold. First, I will perform single-shot readout by incorporating radio-frequency single-electron-transistors into a qubit device. Using

established spin-to-charge conversion techniques, this will allow independent readout of multiple qubits. Second, I will use the exchange coupling between adjacent nanotube quantum dots to implement a universal two-qubit gate. Finally, I will create a long-lived quantum memory based on spin-active endohedral fullerene molecules chemically attached to the nanotube. These molecules have already shown outstanding quantum coherence properties in ensembles, which I will exploit for devices for the first time. The end goal is a device capable of implementing arbitrary two-bit quantum algorithms, opening the way to a scalable quantum computer based on carbon electronics.

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**NBR: 600645** **ACRONYM: SIQS** **EC FUND: 8800000**

**DG:** CNECT **Call: FP7-ICT-2011-9** **Thema:** ICT-2011.9.9

**Title:** Simulators and Interfaces with Quantum Systems

**Abstract:** The overarching goal of our project is to develop systems based on direct and deterministic interactions between individual quantum entities, which by involving large-scale entanglement can outperform classical systems in a series of relevant applications. We plan to achieve that by improving technologies from atomic, molecular and optical physics as well as from solid-state physics, and by developing new ones, including combinations across those different domains. We will explore a wide range of experimental platforms as enabling technologies: from cold collisions or Rydberg blockade in neutral atoms to electrostatic or spin interactions in charged systems like trapped ions and quantum dots; from photon-phonon interactions in nano-mechanics to photon-photon interactions in cavity quantum electrodynamics and to spin-photon interactions in diamond color centers. We will work on two deeply interconnected lines to build experimentally working implementations of quantum simulators and of quantum interfaces. This will enable us to conceive and realize applications exploiting those devices for simulating important problems in other fields of physics, as well as for carrying out protocols outperforming classical communication and measurement systems.

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**NBR: 601126** **ACRONYM: HANAS** **EC FUND: 2500000**

**DG:** CNECT **Call: FP7-ICT-2011-9** **Thema:** ICT-2011.9.9

**Title:** Hybrid Artificial and Natural Atomic Systems

**Abstract:** This project will establish a groundbreaking research program in hybrid quantum systems combining solid state and atomic components. The key elements in this project are devices based on single quantum dots and novel photon storage schemes in atomic

systems. Quantum dots, also known as artificial atoms, enable photon generation in the solid state with functionalities such as tunability, high collection efficiency, radiative lifetime engineering and scalability. Atomic systems are well controlled, exhibit long coherence times and enable the implementation of robust schemes for photon storage. HANAS will demonstrate that a powerful synergy can emerge from hybrid quantum systems where the advantageous functionalities of solid state and atomic systems are combined. We will develop a new type of solid state quantum emitters optimized for coupling to atomic transitions, based on quantum dots in complex nanostructures. New schemes to efficiently couple the emission from single quantum dots with atomic transitions will also be developed and implemented. A range of new hybrid experiments will be carried out that will result in the demonstration of hybrid quantum interconnects where photons generated in a quantum dot will be stored in a rubidium vapour. Additionally, frequency locking techniques borrowed from the atomic community will be implemented in the solid state to counteract spectral diffusion of single quantum dots. To reach our ambitious goals, we bring together European leaders in atomic optics, quantum dot optics, quantum dot growth and nanoprocessing. These achievements will play crucial roles in the development of complex quantum networks.

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**NBR: 601167** **ACRONYM: CSNII** **EC FUND: 950000**

**DG:** CNECT **Call: FP7-ICT-2011-9** **Thema:** ICT-2011.9.11

**Title:** Convergence Science Network of Biomimetics and NeuroTechnology

**Abstract:** Despite tremendous progress in neuroscience, ICT and related fields we are still unable to build perceptive, emotive and cognitive systems that are comparable with even simple insect brains with respect to function, energy sufficiency or computational power. One promising approach to answer this challenge is to translate principles underlying the abilities of natural systems into new technologies. Such an advance would entail major societal and economical impacts, particularly in the areas of information and communication technologies, robotics, brain-machine interfacing, quality of life and health and nanotechnology applied to life sciences. In parallel this paradigm would boost our fundamental understanding of mind and brain: ourselves. Currently the fields of research in Neuro- and Bio-inspired Systems (NBIS) on which these developments depend are critically fragmented, lacking common objectives, methods, critical mass and penetration of the academic curricula with associated obstacles for growth and consolidation. The Coordination Action Convergent Science Network for Biomimetics and Neurotechnology (CSNII) will directly address these challenges. CSNII will advance the definition, visibility, federation and consolidation of research in the Future and Emerging Technology area of NBIS with specific emphasis on Biomimetics and Neurotechnology. CSNII will achieve these objectives by advancing and developing strategic roadmaps, supporting workshops, the annual conference “Living Machines” and realizing global cooperation and alliances in particular through

collaborations with similar and well established activities in the USA and Japan. At the end of this 3 year project we expect a measurable impact on the level of collaboration and the quality of research in Biomimetics and Neurotechnology combined with a direct impact on post graduate curricula and funding policies and mechanisms furthering this strategic field in which Europe can obtain international leadership.

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**NBR: 908002** **ACRONYM: NANOCOAT** **EC FUND: 15000**

**DG:** REA **Call: FP7-PEOPLE-2007-4-2-IIF** **Thema:** PEOPLE-2007-4-2.IIF

**Title:** Development of Self-lubricating Nanocomposite Coatings impregnated with in-situ formed MoS2 for Tribological Applications

**Abstract:** Use of self-lubricated coatings in dynamic contacting parts of the system not only reduces complexity, weight, and cost to the system, but also improves the performance to a great extent by reducing friction and wear. Unlike liquid lubricants, the release of various toxic and harmful chemicals to the environment can also be avoided. So, a self-lubricated surface with a long lifetime is a promising one to meet future challenges. The most common solid lubricants are graphite and transition metals layered dichalcogenides, among which MoS2/WS2 has a great prominence. In this proposal, electrodeposition of Co-W alloys impregnated with MoS2 and WC nanoparticles will be carried out to form nanocomposite coatings by a low cost electrodeposition process. The idea is to impart high hardness and mechanical strength by WC particles for wear resistance; and self-lubrication property by MoS2 particles to a Co-W matrix. Firstly, unlike ELECTROLYTIC CO-DEPOSITION from suspensions of MoS2 nanoparticles, here, emphasis will be on the in-situ formation of MoS2 particles in the electrical double layer followed by their incorporation into Co-W alloys during electrolytic reduction process. Secondly, R&D efforts will be directed to co-deposit WC particles from suspensions along with MoS2 to make self-lubricated wear-resistant nanocomposite coatings. The detailed mechanistic study of MoS2 nucleation and growth; the surface and structural characterization of the nanocomposite coatings, wear and friction property and corrosion will be investigated to understand the structure property correlation. Thirdly, the electrodeposition of Co-W+WC+IF-MoS2 nanocomposite coatings will be carried out from electrolytic suspensions of WC and IF-MoS2 nanoparticles, and the properties will be compared with the former nanocomposites. A special attention will be given on the onset of an implementation of this technology into industrial practice.

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**NBR: 908108** **ACRONYM: SPIVOR** **EC FUND: 15000**

**DG:** REA **Call: FP7-PEOPLE-2007-4-2-IIF** **Thema:** PEOPLE-2007-4-2.IIF

**Title:** Geometrical aspects of spin and vortex dynamics in electromagnetic and matter waves

**Abstract:** The project is intended to reveal a unifying nature and fundamental geometrical features of the spin and vortex dynamics of classical electromagnetic and quantum-mechanical matter waves. The Berry phase, Magnus effect, and spin-Hall effect are attracting ever-increasing interest of scientists because of their potential applications in nano-physics, spintronics, quantum computing, etc. Simultaneously, the modern optics (including nano-optics, photonics, and plasmonics) offers unique possibilities to test and apply fundamental quantum-mechanical ideas within classical systems. The striking similarities of the spin and vortex dynamics in electromagnetic and matter waves call for an in-depth theoretical analysis which will be given within the framework of the present project. We will carry out extensive theoretical investigations of the propagation and scattering of electromagnetic waves in inhomogeneous and anisotropic media. A special attention will be paid to dynamics related to spin (polarization) and orbital (optical vortices) angular momenta of light. The research will be concentrated on various manifestations of spin-orbit-type interactions between intrinsic and extrinsic degrees of freedom of electromagnetic waves and quantum particles. We aim to develop a unifying theoretical approach to be able to describe specific features of behaviour of spins and vortices evolving in external fields. The approach will include the fundamental geometro-dynamical effects: the Berry phase, spin-Hall effect, and Magnus effect. Using scope of the host laboratory, we are going to perform experimental test of fine manifestations of these effects in classical optics, with potential applications to fiber optics, metamaterials, and remote sensing of turbulent atmosphere. We anticipate that realization of the project will contribute to the ability to control complex wave fields of different nature and, thus, will have a profound interdisciplinary impact and applications.

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**NBR: 908419** **ACRONYM: MATERIALS NANOMECH** **EC FUND: 11250**

**DG:** REA **Call: FP7-PEOPLE-2007-4-2-IIF** **Thema:** PEOPLE-2007-4-2.IIF

**Title:** Nanomechanics of defects in solids: applications to nanolayers, nanoparticles, nanocrystals and biomaterials

**Abstract:** The aim of the proposed project is to continue the research on a general nanomechanics of defects framework for the understanding and prediction of structure-properties relationships of nanoscale materials. This framework has to be suitable for metal nanoparticles and nanorods, nanolayered films and core/shell nanowires, ultrafine grained bulk nanostructures, as well as carbon nanotubes and protein membrane nanotubes. While standard continuum mechanics and dislocation theory have been useful tools for addressing scientific and technological problems at macro and meso scales, their direct use is not suitable for nanoscale problems. Molecular dynamics simulations and their variants is a commonly used approach but also prohibitively

expensive for realistic applications due to current computational limitations. The proposed project serves as a compromising alternative by developing a new methodology for understanding the evolution and stability of structural defects at nanosized volumes and advancing new continuum nanoelasticity and nanoplasticity models for capturing the deformation and fracture behavior of nanosized objects, devices and components. The results will be applicable to a variety of nanoscience and nanotechnology areas, including micro/nano opto-electronics, micro/nano electromechanical systems, bulk nanostructured metal processing and forming. For the last objects, i.e. bulk nanostructured materials, experimental studies of their fracture and plastic behavior will be conducted to support the developed theory.

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**NBR: 908423** **ACRONYM: MIND** **EC FUND: 15000**

**DG:** REA **Call: FP7-PEOPLE-2007-4-2-IIF** **Thema:** PEOPLE-2007-4-2.IIF

**Title:** Investigation of electron induced chemical control using momentum imaging of negative ions from dissociative electron attachment

**Abstract:** This proposal aims at investigating chemical control using electrons by studying the dynamics of the dissociative electron attachment in gas phase molecules of practical interest using ion momentum imaging. These experiments will be complemented by measurements on molecules condensed on surfaces using electron beam irradiation as well as scanning tunneling microscopes. The proposal is motivated by the recent observations by several groups on molecules in gas and condensed phases that dissociative attachment allows control of electron induced processes. In particular, the group led by the applicant showed that functional group dependence exists in dissociative attachment allowing site/bond selective fragmentation of organic molecules using electron energy as a control parameter. They further investigated the dynamics of this process in selected small molecules using a novel technique developed by them for ion momentum imaging in low energy electron collisions. This technique allows characterization of the intermediate resonant state, the fragmentation pattern and the energy partitioning in the product channels. It is proposed to set up a similar experiment for ion momentum imaging arising from dissociative attachment and polar dissociation in molecules relevant to nanolithography, astrochemsitry and radiation biology at the host institution. These experiments will be complemented by experiments on molecules condensed on surfaces by electron beam irradiation and by using scanning tunneling microscopes with a view to correlate the energy partitioning in the dissociative attachment process and the reactivity of the products. While the applicant brings in expertise on gas phase measurements like absolute partial cross section measurement and ion momentum imaging, the host group and his collaborators provide necessary expertise and facilities for complementary experiments in condensed phase and on surfaces.

**NBR: 908507** **ACRONYM: NANO-PHOTOMED** **EC FUND: 15000**

**DG:** REA **Call: FP7-PEOPLE-2007-4-2-IIF** **Thema:** PEOPLE-2007-4-2.IIF

**Title:** Targeted Nano-Photomedicines for Multi-spectral Photodynamic Therapy of Cancer

**Abstract:** We propose to develop multifunctional, targeted nano-photomedicines that are capable of bypassing biological barriers to deliver nano-engineered photosensitizer drugs and molecular-imaging agents to tumor tissues and angiogenetic micro-vasculature. Specifically, a unique nanomedicine system for targeted multi-spectral photodynamic therapy is proposed. The system consists of (i) luminescent quantumdot (QD) conjugated with photosensitizer (PS) drugs, which can be sensitized at its maximum efficiency using radiations of deep-tissue penetration (ii) molecular-imaging agents for the early stage detection and in situ treatment-effect analysis (iii) active targeting ligands to specifically target tumor and micro-vasculature. During the incoming phase, QDs of ZnS, Y2O3 and Gd2O3 emitting multi-spectral light under excitation with deep high-tissue penetrating radiations will be conjugated with PS so as to sensitize them at their characteristic absorption using Fluorescent Resonant Energy Transfer (FRET). The QD-PS will be combined with MRI contrast agents using `core/shell' nanotechnology and made water soluble by capping with polyethylene glycol (PEG). Finally, the nanomedicine will be connected with tumor specific ligands such as folic acid, MAbs and peptides. Optimization of nanomedicine will be carried out by studying dark and photo-toxicity in normal and cancer cell-lines in vitro. Photodynamic treatment will be carried out in pre-clinical animal models using multispectral radiations under different photo- and drug-dose conditions, followed by molecular imaging (MRI) based estimation of PDT response-dose inter-relationships. During the return phase, scanning probe imaging based investigations on the mechanism-of-activity of nano-photomedicines at intra-cellular regions leading to cell-death (apoptosis) will be investigated.

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**NBR: 908582** **ACRONYM: FEMTONANO** **EC FUND: 15000**

**DG:** REA **Call: FP7-PEOPLE-2007-4-2-IIF** **Thema:** PEOPLE-2007-4-2.IIF

**Title:** Femtosecond laser induced nanoclusters in glasses for photonic applications

**Abstract:** Lately composite materials containing metal nanoparticules have found an increasing number of applications in different fields of science and technology. In particular glasses containing metallic nanoparticules are of great interest for photonics because of their unique linear and nonlinear optical properties, which are determined by surface plasma oscillations of the metal clusters. The surface plasmon resonance depends strongly on

shape, distribution and concentration of the nanoparticules, as well as on the surrounding dielectric matrix. This offers the opportunity to manufacture very promising new nonlinear materials, nanodevices and optical elements by manipulation of the nanostructural properties of the composite medium. Recently, laser-based techniques leading to modifications of shape and size of the metal clusters have increasingly become of great interest and proved to provide a very powerful and flexible tool to control and optimize the linear and nonlinear optical properties of such materials. More generally, this technique allows the engineering of the optical properties of the material via gaining control over the spatial distribution of nanoparticules in the glass matrix. The possibility to 3D spatially structure the linear and non-linear properties of various materials leads thus to consider femtosecond laser as a fantastic tool. However, a deeper understanding of the light-matter interaction, with emphasis on multiphotons processes, is profoundly needed for the development of new optical devices based on nanoparticules mastering. This proposal is thus dedicated to 1/ to understand the processes of the formation of metallic nanostructures in glassy media and 2/ to manipulate, to master the nanocluster shape and mostly distribution within the dielectric matrix. This will allow structuring the non-linear properties in the dielectric matrix on demand.

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**NBR: 908690** **ACRONYM: GAKO2007CA** **EC FUND: 15000**

**DG:** REA **Call: FP7-PEOPLE-2007-4-2-IIF** **Thema:** PEOPLE-2007-4-2.IIF

**Title:** Development of multiscale methods in planning of nano MEMS

**Abstract:** The mathematical multiscale theories intensively developed in the last decades and collected high potential of theoretical methods. These methods are not completely used in engineering, although there exists a great variety of arguments evidently related to problems treated by the multiscale theories. The aim of this project is to give a contribution for closing this "gap" through joint work of mathematicians, mechanics and engineers. The specific goal of the project is to develop multiscale methods in nanotechnologies with orientation to prediction of new effects in complex structures as nano MEMS (Micro-Electro-Mechanical Systems). We hope that the effects found not only will demonstrate effectiveness of mathematical multiscale theories as method solution of applied problems but will lead to design new structures, materials and devices.

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**NBR: 909407** **ACRONYM: NANOALLOY** **EC FUND: 15000**

**DG:** REA **Call: FP7-PEOPLE-2009-IIF** **Thema:** FP7-PEOPLE-2009-IIF

**Title:** Induced electrodeposition of nanostructures as nanowires and nanotubes consisting of cobalt-based multilayers for MEMS applications

**Abstract:** Purpose of the project: This project is focused on the synthesis by induced electrodeposition of nanowires and nanotubes as multilayered structures consisting of cobalt alloys with refractory metals like Mo and W. Hereto the superfilling of nanopores present as arrays in anodized aluminium oxide (AAO), will be investigated in-depth. First proofs of principles have been recently achieved by the applicant. The background of the host institution on electrodeposition in micro-pores (e.g. vias used in microelectronics) and its modeling is a most important support to this project. Objectives of research: - To develop at the host institution the scientific insight required for the lab demonstration of the technological feasibility of the novel concept of producing nanostructures (nanotubes, nanopores) with different aspect ratios in AAO by a low cost electrodeposition from environmental-friendly aqueous electrolytes, - To transfer the scientific knowledge to a third country with the objective of nurturing present collaboration and to explore the possibility of further collaboration between researchers and industry inside and outside EU, - To train an experience researcher from a developing country by a European specialist on electrodeposition and tribological testing. Expected research results: - The electrodeposition of cobalt-based homogeneous and multilayered nanotubes and nanowires engulfed in anodized aluminium, and as free-standing products after release from anodized aluminium. - Scientific insight on the role of electrochemical parameters on structural and functional properties of electrodeposited nanotubes and nanowires either engulfed or released from anodized aluminium. - Mapping of the functionality of nanotubes and nanowires made of compositionally modulated layers in view of future applications in MEMs and NEMs technology as wear resistant and/or electro-magnetic materials. .

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**NBR: 909920** **ACRONYM: NANOSOLD** **EC FUND: 15000**

**DG:** REA **Call: FP7-PEOPLE-IIF-2008** **Thema:** FP7-PEOPLE-IIF-2008

**Title:** A Chemical Approach to Lead-free Nanosolders

**Abstract:** Physical, electronic and thermodynamic properties of small particles (nano-particles) differ significantly from those of the bulk materials, and the depression of the melting temperature below the melting point of the bulk has been known for a long time. This dependence of the melting temperature on the particle size is not restricted to any particular material and may therefore also be exploited to lower the melting temperatures of lead-free solders. At the same time, the high-temperature solders currently in use (melting temperatures 250-400°C) contain high amounts of lead and are exempt from the European RoHS directive due to reliability reasons. In the search for lead-free substitutes, Sn-Sb and Sn-Sb-M alloys have been identified as possible candidates. With the envisaged reduction of the grain size into the nanometer range and

a corresponding lowering of the melting temperature, considerable energy savings would become possible in the first soldering step without sacrificing the stability of the obtained solder junctions against re-melting in the further assembling procedure. Therefore it is proposed to prepare micro- and nanosized particles of lead-free high-temperature solder materials, based on Sn-Sb-M (M=Ag, Cu, Ni) from suitable chemical precursors. These precursors will be prepared by precipitation reactions, followed by thermal decomposition and, if necessary, by adequate reduction reactions, and the reaction conditions will be optimized. The particles will be characterized by chemical analysis, SEM and TEM, and by thermo-analytical methods, and the corresponding properties will be compared with those of bulk materials. At the same time, additional experiments in the bulk systems Sn-Sb-Ag and Sn-Sb-Cu will be performed to complete the available literature information on phase diagram and thermodynamics. It will be attempted to model the phase diagrams for bulk and for nano-sized materials by the well known CALPHAD-method.

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**NBR: 910686** **ACRONYM: MOEBIUS** **EC FUND: 15000**

**DG:** REA **Call: FP7-PEOPLE-2010-IIF** **Thema:** FP7-PEOPLE-2010-IIF

**Title:** Multifunctional Organic-inorganic Elements with Biosensing re-Usability

**Abstract:** The main objective of the project is to bring together recent advances in semiconductor nanostructures, organic molecule self-assembling and bio-interfacing to develop a new generation of biosensors for in situ environmental monitoring and life science applications. Tunable electronic material with pores on semiconductors produced by swift heavy ion-track-based patterning forms an attractive foundation for interfacing conventional electronics with bio-active sensor compounds. Nano-sized channels of ion-track based structures modified by metal oxides in combination with a self-assembled layer of organic or bio-organic sensor layer can multiply the response of the device by many orders of magnitude as compared to conventional sensor architecture. Thus the fundamental goals of the project are nanofabrication of such state-of-the-art structures and exploring of the interactions between bio-molecules and novel nanomaterial. To fulfill objectives of the project a multidisciplinary research team is formed. The expertise of the team covers all key areas, including fabrication of the TEMPOS structures; synthesis functional organic and bioorganic molecules and self-assembling of molecular layers; structural and functional (including photo-/electro-activities) characterizations; theoretical ab initio computations. The novel reusable biosensors will allow quantitative analysis of toxins and key biomarkers important for diagnostics of liver deceases with high accuracy and reliability. The industrial partners will complement fundamental research by prototyping the biosensors and testing them in situ, thus ensuring the fast conversion of the results to production technologies.

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**NBR: 911027** **ACRONYM: ORBITAL IMAGING** **EC FUND: 15000**

**DG:** REA **Call: FP7-PEOPLE-2011-IIF** **Thema:** FP7-PEOPLE-2011-IIF

**Title:** Electron orbital resolution in scanning tunneling microscopy

**Abstract:** Scanning Tunneling Microscopy (STM) has become one of the basic techniques for the analysis of surface reconstructions, overlayer growth mechanisms, surface dynamics and chemistry at the atomic scale. STM is used in physics, chemistry and biology for investigation of organic and inorganic nanoobjects. However, the mechanisms of STM image formation are still not completely understood. The proposed project will be focused mainly on two unresolved issues. The first research focus is related to fabrication of functionalized STM probes with well defined electronic (orbital) structure. To control the electronic structure of the STM tip apex, oriented single crystal probes will be used. The second research focus is related to experimental and theoretical studies of the STM tip and surface atoms interaction and the role of different electron orbitals of the both tip and surface atoms in the STM image formation process. The atom-atom interaction at extremely small tunneling gaps as well as distance and bias voltage dependent contribution of separate electron orbitals will be studied experimentally using scanning tunneling microscopy and spectroscopy at room and low temperatures. The experimental data will be analyzed in a conjunction with results of theoretical (density functional theory and tight binding) calculations. The project activity can provide new fundamental understanding of the atomic scale objects and give some keys for controllable probing separate electron orbitals of individual atoms with STM. This can advance the surface analysis methods necessary for development of nanoscience and nanotechnology. The selective orbital imaging capability can allow to reach ultimate spatial resolution, spin sensitivity at the atomic scale and controllable chemical discrimination of atomic species on surfaces using STM that are essential for physics, chemistry, biology, medicine and materials science.

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**NBR: 911723** **ACRONYM: AQUACAT** **EC FUND: 15000**

**DG:** REA **Call: FP7-PEOPLE-2011-IIF** **Thema:** FP7-PEOPLE-2011-IIF

**Title:** Tailor made lipases for synthetic catalysis in biphasic media: From poly (lactone) applications towards novel sugar esters

**Abstract:** AquaCat aims to design greener chemical processes by combining the use of lipase catalysis to that of aqueous biphasic reaction media with a specific view to the synthesis of poly(lactone) nanoparticles and sugar esters for pharmaceutical, cosmetical and chemical applications. A multidisciplinary approach encompassing physical chemistry and polymer science as well as industrial biotechnology, biocatalysis and enzyme

technology will be followed to cover the various relevant scales. AquaCat will tailor the lipases microenvironment, design the reaction medium making lipase function as synthetic catalyst of confined organic substrates and identify the relevant parameters for industrial scale up of these processes. AquaCat will thus circumvent major problems in the current manufacturing processes making the use of organometallic catalysts, hazardous organic solvents, high energy consumption and multi-steps for nanoparticle elaboration obsolete. Lipases will be used to catalyze the ring-opening polymerization in nano-emulsions consisting of lactone nanodroplets dispersed in aqueous or aqueous-biphasic systems. The most innovative aspect of AquaCat is to directly synthesize the core-shell poly(lactone) in one step in water. The same principle will be applied to the synthesis of important specialty chemicals like sugar esters based on renewable feedstock. A trademark of this project will thus be the possibility to transfer and merge the expert's fundamental background in colloid/polymer science, industrial biotechnology and biocatalysis from the third country into the EU giving novel insights into the basic reaction mechanisms and the influence of the emulsion properties on enzyme catalysis. Thus, AquaCat will create mutually-beneficial research co-operations and enable the application of results to other valuable substrates and could soon become a feasible strategy for the European industry to design sustainable processes for high value-added products.

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**NBR: 911932** **ACRONYM: NOVOSIP** **EC FUND: 15000**

**DG:** REA **Call: FP7-PEOPLE-2011-IIF** **Thema:** FP7-PEOPLE-2011-IIF

**Title:** Nano-Voids in Strained Silicon for Plasmonics

**Abstract:** The project aims at exploring the use of nanovoids and nanodots prepared as plasmonic structures to enhance the efficiency of Si single-crystalline photovoltaic (PV) devices. Fabrication and experimental investigation of plasmonic structures in strained Si/SiGe multilayered structures will be carried to enhance light harvesting in solar cells due to both near-field and far-field effects. The main idea behind the production of nanovoids and nanodots is based on the ability of compressively strained thin SiGe alloy layers, incorporated in a Si matrix during epitaxial growth, to collect small-sized molecules (H, He, C) or vacancies, induced by irradiation. Further, thermal treatment results in the formation of nano-voids which are strictly assembled within the strained SiGe layers. The following key processes will be used: Molecular beam epitaxy of strained Si/SiGe/Si structures followed by irradiation with light ions (hydrogen, carbon) and rapid thermal treatment. This structure will then be additionally used as a template for segregation and self-assembling of metallic or carbon nanodots. The fundamental investigations of the structural, optical and electronic properties of the strained Si/SiGe layers will be carried out with a range of available methods for structural, electronical and optical characterization. By placing the nanovoids and nanodots in a highly doped emitter layer close enough to the p-n-junction that the near-fields will extend into the depletion layer,

the effects of near-fields will be obtained. This will give a contribution to the electron-hole pair generation, and this will be additional to the far field effects. Being formed periodically, strained layers with self-assembled nanovoids or nanodots will display fundamentally unusual electronic and optical properties. These effects have not previously been experimentally studied in a solar cell configuration. The present system offers a unique configuration for such investigation.

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