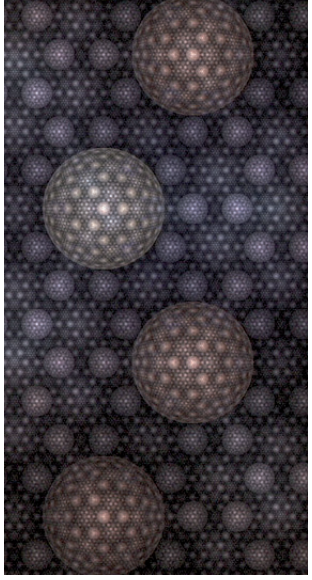

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report
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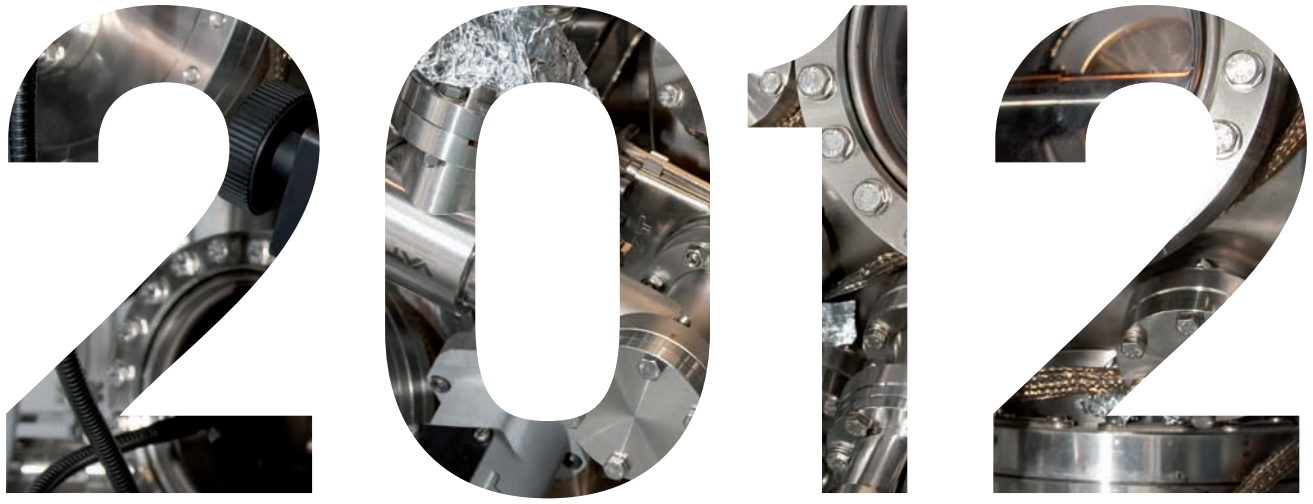


foreword

foreword

Rodolfo Miranda
Director, IMDEA Nanoscience Institute
april 2013

annual report
2012

In 2012 we have achieved a much-awaited milestone for IMDEA Nanociencia: we have moved to our building that is fully operational since June 2012. A brand new time for the Institute, a time to fully develop its potentialities has started.

In 2012 one of our youngest researcher has been granted with an Starting Grant from the ERC and the Institute has started the coordination of two European Union projects, being also involved in two new European consortiums. The scientific production has been extraordinary, with 127 papers available in high impact publications (average impact factor 5.67, among the highest in Spanish scientific institutions), with an average citation index per article of 10.07 and an overall institutional h index of 28, an amazing achievement for an institution with such a brief existence. These efforts have been recognized with awards to the best article in the journal of the RSEF and the presidency of the young chemist group in the RSEQ, among other distinctions.

Working in close cooperation with highly innovative industries has always been our challenge and so IMDEA-Nanociencia is setting up a new model of partnership that incorporates the strategic needs of businesses and end users as early as possible in the research process. Through basic science the Institute is exploring, together with private partners, new nanoscience applications that could potentially break through the frontier of current technology in such fascinating fields as cancer treatment, medical imaging, functionalized composite materials for aerospace industry or organic solar cells. In some instances this is done through large collaborative projects including other major European research centers, while in others it is through direct contracts with companies.

According to the 4th year evaluation by the Scientific Advisory Committee in December 2012, the high level of excellence and interdisciplinarity and the compromise of all the scientific and administration staff are the keys of the success of the Institute, and values that we must preserve.

I would like to thank the members of the Institute for their enthusiastic participation in the various tasks in which they have been involved and the regional and national Administrations for their continuous support.

table of contents

table of contents

annual report

2012

overview

annual report 2012

1.1. Legal Status

IMDEA-Nanociencia is a private non profit Foundation created by initiative of the the regional Government of the Community of Madrid in November 2006 in order to shorten the distance between the research and society in the Madrid region and provide new capacity for research, technological development and innovation in the field of Nanoscience, Nanotechnology and Molecular Design. In 2007 the former Ministry of Education and Science of the Government of Spain decided to also fund part of the creation and equipment of an institute of Nanoscience in the Community of Madrid.

The Foundation is governed by a Board of Trustees, which contains representatives of the Administration, the Academic Institutions (Universidades Complutense, Autónoma, Politécnica de Madrid, Consejo Superior de Investigaciones Científicas), industries, members of the Scientific Advisory Council, and experts in societal implications of nanoscience and technology transfer.

The Foundation manages the IMDEA-Nanociencia Institute, a new interdisciplinary research centre dedicated to the exploration of basic nanoscience and the development of applications of nanotechnology in connection with innovative industries.The IMDEA-Nanociencia Institute is part of one of the strategic lines of the Campus of International Excellence (CEI) UAM+CSIC.

1.2. Strategic Goals

In the region of Madrid there is already a large community of physicists, chemists and biologists working actively on diverse aspects of Nanoscience. Many of these groups have a recognized international prestige in their respective fields. In spite of that, a new step forward is needed to facilitate the future international competitiveness of the R+D in Nanoscience and Nanotechnology; it is necessary to create a suitable organizational and working environment to promote the continuous interdisciplinary interaction between specialists in condensed matter physics, chemistry, molecular biology, computer sciences, etc, that demands the very nature of this new discipline.

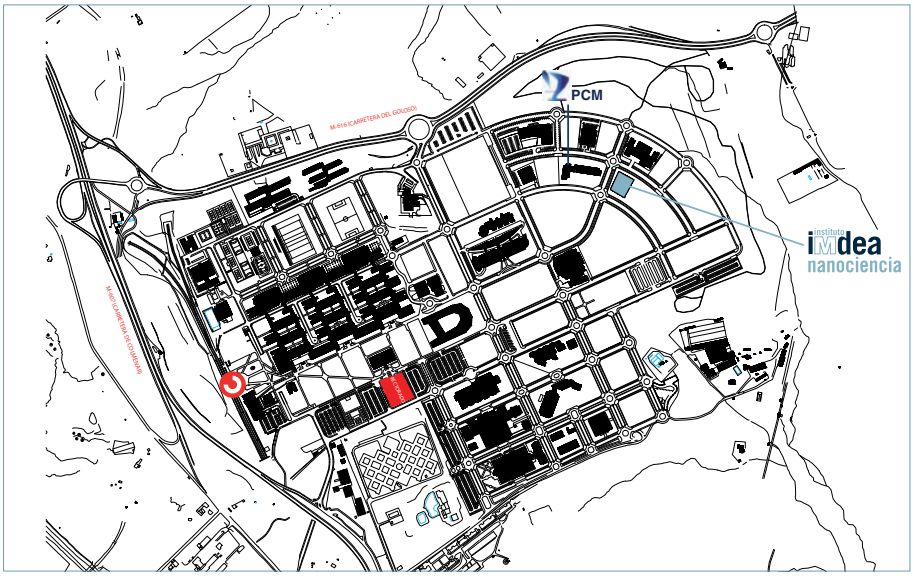
Moreover, it is essential to be able to recruit and retain new talent and to repatriate some young scientists that are abroad, to train a new generation of technicians and scientists in a genuine interdisciplinary and to create and maintain new experimental equipments and advanced infrastructures.

All this must be done coordinating efforts with the groups and institutions that already exist by means of a flexible structure based on research programmes, which will have to pass a demanding periodic evaluation. IMDEA-Nanoscience aims at becoming an internationally recognized research center, while maintaining a clear support from the existing scientific community in Madrid.

1.3. Location

IMDEA Nanociencia has been located provisionally mostly in spaces from the School of Sciences of the UAM and the School of Chemistry of the UCM. The building of IMDEA Nanociencia is at the Campus of the UAM in Cantoblanco, near Madrid. Given the interdisciplinary nature of research in Nanoscience, the location of the Institute in an environment characterized by its excellence in related research areas is ideal.

The foundation stone was laid on a public ceremony on January, 13th, 2010. The building was completed by December 2011 and is fully operational since June 2012.It has 8.200 m^2 of space for labs, offices and facilities such as the Center for Nanofabri-



IMDEA Nanociencia. Universidad Autónoma de Madrid. Cantoblanco Campus.

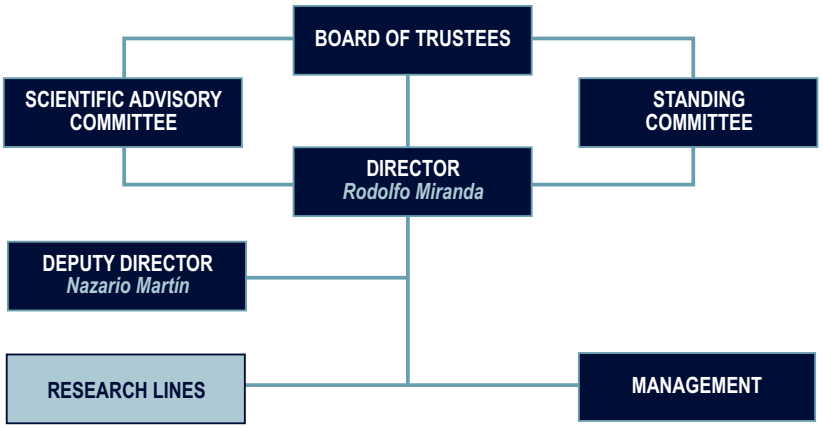
cation of the Campus of International UAM+CSIC or the Center for Ultra-High Resolution Electron Microscopy.

The new building of IMDEA Nanoscience will host approximately 100 senior and postdoctoral researchers from different areas, 20 laboratory technicians, 15 staff members for management and administration and the appropriate number of graduate students.The building is designed to have sufficient free space to ensure the rotation of research groups and the future incorporation of new programmes and areas.

1.4. Recruitment Procedure

Staff scientists of IMDEA Nanociencia are recruited on the basis of International Open Calls in which the candidates present a scientific proposal and a CV. The Scientific Advisory Committee selects a group of candidates to be interviewed by the Direction. After the selection and negotiation process, the candidates are presented to the Board of Trustees and then the offer is made. Postdocs and Ph. D. are also recruited on an internationally competitive basis, but selected directly by their corresponding supervisors from the staff. Researchers from different universities, the CSIC or other public institutions may also apply to the same selection procedure and be incorporated to the Institute as associated members for periods of five years to develop specific research projects. The corresponding agreements with different academic institutions have been signed.

1.5. Management Structure



1.6. Board of Trustees

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Director at the Max Planck Institut für Mikrostrukturphysik, Halle. Germany

Prof. Emilio Méndez
Director of the Center for Functional Nanomaterials (CFN). Brookhaven National Laboratory Upton, NY. USA

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Dipartimento di Science Farmaceutiche. Universita di Trieste. Italy

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Prof. Ivan Schuller
Physics Department and California Institute of Telecommunication and Information Technology (Calit2) University of California-San Diego. USA

Prof. Fred Wudl
Department of Chemistry and Biochemistry University of California, Santa Barbara. USA

research programmes and scientists

annual report

2012

Programme 1

Molecular Nanoscience:

- Chemical Synthesis
- Time resolved Optical Spectroscopy

Programme 2

Scanning Probe Microscopies and Surfaces

Programme 3

Nanomagnetism

Programme 4

Nanobiosystems: Biomachines and Manipulation of Macromolecules

Programme 5

Nanoelectronic and Superconductivity

Programme 6

Nanoacustics and Nanophotonics/ Nanooptics

programme 1
molecular nanoscience

This programme deals with the design and synthesis of molecular nanostructures and nanomateriales, their spectroscopic characterization, in particular, their time-resolved optical response, and their self-assembly at surfaces. The expertise required includes the functionalization of different nanoforms of carbon, organometallic compounds and semiconducting quantum dots to self-organize on surfaces by means of covalent or supramolecular approaches and the implementation of various spectroscopic techniques, including spectroscopy on single molecules. Among the practical objectives of the Programme one may cite the optimization of organic solar cells and other functional organic devices.

Chemical synthesis

Prof. Nazario Martín

Programme Manager

Double Affiliation: Universidad Complutense de Msdrid, Spain

Nazario Martín (Madrid, 1956) is full professor of Organic Chemistry at the University Complutense of Madrid and vice-director of the Institute for Advanced Studies in Nanoscience of Madrid (IMDEA-Nanoscience). Recently he has been appointed as Dr. h.c. by La Havana University. Professor Martín's research interests span a range of targets with emphasis on the molecular and supramolecular chemistry of carbon nanostructures such as fullerenes, carbon nanotubes and graphenes, p-conjugated systems as molecular wires and electroactive molecules, in the context of electron transfer processes, photovoltaics applications and nanoscience. He has published over 420 papers in peer reviewed journals, given over 260 lectures in scientific meetings and research institutions, and supervised 25 theses. He has co-edited six books related with carbon nanostructures and he has been invited as guest editor for eight special issues in well-known international journals. Professor Martín has been visiting professor at UCSB and UCLA (California, USA) and Angers and Strasbourg (France) universities. He has served as a member of the Editorial Board of Chemical Communications, and he has served as General Editor of the Spanish journal Anales de Química (2000-2005) and as a member of the International Editorial Advisory Board of The Journal of Materials Chemistry (2000-2006). He is currently the Regional Editor for Europe of the journal Fullerenes, Nanotubes and Carbon Nanostructures and a member of the International Advisory Board of The Journal of Organic Chemistry (ACS), ChemSusChem (Wiley-VCH), ChemPlusChem (Wiley-VCH), Chemical Society Reviews (RSC) and Chemical Communications (RSC). He is a member of the Royal Academy of Doctors of Spain as well as a fellow of The Royal Society of Chemistry. In 2006-2012 he has been the President of the Spanish Royal Society of Chemistry. He has been the recipient of the "Dupont Prize of Science" in 2007 and of the "Gold Medal and Research Award" in 2012, the highest distinction given by the Spanish Royal Society of Chemistry. He has recently been appointed with the national "Jaime I Award for basic research" 2012. He is the last chemist distinguished with the "EuCheMS Lecture Award" in 2012.

Relevant publications

- "Switching the Stereoselectivity: (Fullero)Pyrrolidines "a la Carte", E. E. Maroto, *et col.* *J. Am. Chem. Soc.*, **134,** 12936-12938 (2012)
- "Tetrathiafulvalene-Based Nanotweezers—Noncovalent Binding of Carbon Nanotubes in Aqueous Media with Charge Transfer Implications", C. Romero-Nieto *et col.* *J. Am. Chem. Soc.*, **134,** 9183-9192 (2012)
- "Concave versus Planar Geometries for the Hierarchical Organization of Mesoscopic 3D Helical Fibers", J. L. López, *et col.* *Angew. Chem. Int. Ed.*, **51,** 3857-3861 (2012)

Hybrid systems based on semiconductor nanoparticles

Dr. Beatriz H. Juárez

Associated Scientist

Ph.D.: Universidad Autónoma de Madrid, Spain

Double Affiliation: Universidad Autónoma de Madrid, Spain

Beatriz Hernández Juárez is associated professor at the Universidad Autónoma de Madrid (from Sep.12) and former researcher in the "Ramón y Cajal" programme at IMDEA Nanoscience. She received a B.Sc. degree in Chemistry from the Universidad Complutense de Madrid (UCM) in 1999 and a Ph.D degree in Material Sciences from the Universidad Autónoma de Madrid (UAM) in 2005 with a work on Photonic Crystals supervised by Prof. C. López. Dr. Hernández also worked for almost 2 years in Lucent Technology, a factory devoted to the fabrication of microelectronic circuits in a clean room laboratory. After finishing the PhD, she moved to the Laboratoire de Photonique Quantique et Moléculaire (LPQM) in Paris. After a short stay, she joined the group of Prof. Dr. Horst Weller in Hamburg (http://www.chemie.unihamburg.de/pc/weller/index.html) with a Marie Curie Individual Intra European Fellowship.

Research lines

- Studies about the interactions between carbon nanotubes or graphitic surfaces and semiconductor nanoparticles. Synthesis, analytical, electrochemical and microscopical characterization.
- Composites based on carbon fibers for mechanical and electrical aims.
- Synthesis and optical characterization of hybrid systems composed of semiconductor and metallic nanoparticles.
- Quantum dots in photonic crystals.

Relevant publications

- "Ultrathin PbS Sheets by two dimensional oriented attachment" Constanze Schliehe, *et col. Science* **329**, 550-553, 2010 (Front-Cover)
- "Quantum Dot Attachment and Morphology Control by Carbon Nanotubes" B. H. Juarez, *et col. Nano Lett.*, 2007, **7** 3564–3568
- "High Energy Photonic Bandgap in Sb_2S_3 Inverse Opals by Sulfidation Processing" B. H. Juárez, *et col. Adv. Mater.* 2002, **15**, 319-323

Dr. Cristina Palencia

Postdoc

Instituto de Cerámica y Vidrio (CSIC), Madrid, Spain

Leonor de la Cueva

Research Assistant

María Acebrón

Internship

Supramolecular chemistry and self-assembly of functional materials

Dr. Emilio Pérez

Researcher

Ph.D.: University of Edinburgh, UK

Previous Position: Universidad Complutense de Madrid. Spain

Emilio M. Pérez obtained his BSc (2000) and MSc (2001) from the Universidad de Salamanca, working in the design and synthesis of enantioselective receptors for a-aminoacids under the supervision of Prof. Joaquín R. Morán. He then joined the group of Prof. David A. Leigh at the University of Edinburgh (UK) where he obtained his PhD in 2005. His PhD work was recognized with the 1st Prize at the 2004 Society of Chemical Industry Symposium on Novel Organic Chemistry and the 2006 IUPAC Prize for Young Chemists. He joined the group of Prof. Nazario Martín at the Universidad Complutense de Madrid in 2005. During his stay in Madrid, he has received the 2009 Real Sociedad Española de Química Prize for Novel Researchers and the 2010 Universidad Complutense de Madrid Foundation Prize for Science and Technology. In December 2008 he joined IMDEA Nanoscience as a Ramón y Cajal researcher.

In 2011-2012 he received support from both Spanish (MINECO, group A call) and European (ERC Starting Independent Research Grant) sources to establish his own research group at IMDEA. His main research interests concern the development of unconventional methods for the modification of carbon nanotubes, molecular recognition, the self-assembly of functional materials and the construction of molecular machinery.

Research lines

- Synthesis of organic molecular materials.
- Molecular recognition of carbon nanostructures.
- Supramolecular chemistry.
- Self-assembly of functional materials.

Relevant publications

- "Self-Organization of Electroactive Materials: A Head-to-Tail Donor-Acceptor Supramolecular Polymer" G. Fernández, *et col. Angew. Chem. Int. Ed.* 2008, ***47***, 1094-1097
- "exTTF an Building Block for Fullerene Receptors. Unexpected Solvent-Dependent Positive Homotropic Cooperativity" E M Pérez, *et col. J. Am. Chem. Soc.* **128** (2006), 7172-7173
- "Macroscopic Transport by Synthetic Molecular Machines" J Berná, *et col. Nature Materials* **4**, 704-710 (2005)

Dr. Fulvio Brunetti

(until February 2012)

Postdoc

University of California Santa Barbara, USA

Helena Isla

Ph.D. student

Alberto de Juan

Ph.D. student

Alejandro López

Ph.D. student

Design and synthesis of molecular nanostructures and nanomaterials

Dr. Juan Luis Delgado

Researcher
Ph.D.: Universidad de Castilla-La Mancha, Spain
Previous Position: Universidad Complutense de Madrid. Spain

Juan Luis Delgado obtained his PhD in Chemistry (2004) from the Universidad de Castilla-la Mancha, with a work on materials for photovoltaic applications. He then joined the group of Prof. Jean-François Nierengarten, at the CNRS (Strasbourg and Toulouse, France) working on covalent and supramolecular fullerene chemistry and conjugated systems (2005-2006). Currently, he holds a "Ramón y Cajal" research contract at IMDEA-Nanociencia, where he is focused on the synthesis and design of new carbon-based energy storing materials for the development of more efficient organic photovoltaic devices. He is co-author of more than 50 papers and book chapters, and currently, he is the president of the group of Young Chemists Researchers of the Spanish Royal Society of Chemistry (RSEQ) http://www.rseq.org/jiq.htm.

Research lines

- Improvement of the performance of Bulk HeteroJunction (BHJ) Solar Cells. We are focused on the synthesis of new donor and acceptor light harvesting materials in order to prepare more efficient solar cells.
- Synthesis of new organic dyes, based on donor-acceptor systems, to prepare new efficient Dye Sensitized Solar Cells (DSSC).
- Synthesis of donor-acceptor and donor-acceptor$_1$-acceptor$_2$ systems, to study the electron transfer events that take place on these systems.

Relevant publications

- "Efficient Electron Transfer and Sensitizer Regeneration in Stable pi Extended Tetrathiafulvalene-Sensitized Solar Cells" Wenger S., *et col.* *J. Am. Chem. Soc.* **132** (2010) 5164-5169
- "Synthesis, Photochemistry, and Electrochemistry of Single-Wall Carbon Nanotubes with Pendent Pyridyl Groups and of their Metal Complexes with Zinc Porphyrin. Comparison with Pyridyl-Bearing Fullerenes" Alvaro M., *et col.* *J. Am. Chem. Soc.* **128** (2006) 6626-6635
- "Infrared Photocurrent Spectral Response from Plastic Solar Cell with Low-Band-Gap Polyfluorene and Fullerene Derivative" Wang XJ, *et col.* *Appl. Phys. Lett.* **85**, 5081, 1-4 (2004)

Dr. Damien Joly

(until September 2012)
Postdoc
University of Rennes 1, France

Carmen Villegas

Ph.D. student

Organic Functional Materials

Prof. Tomás Torres

Associated Senior Scientist
Ph.D.: Universidad Autónoma de Madrid, Spain
Double Affiliation: Universidad Autónoma de Madrid, Spain

Tomás Torres is Professor of Organic Chemistry at UAM. His group, twenty five researchers, has an experience of 20 years in Organic Molecular Materials. He has published 370 papers and 40 patents, given 200 lectures, and supervised 30 PhD. theses. In 2001 he was distinguished as a Visiting Fellow of the Japan Society for the promotion of Science. He has been awarded the JANSSEN CILAG prize for Organic Chemistry 2005 by the Royal Society of Chemistry of Spain. In 2009 He has also been honoured as Doctor Honoris Causa by the Ivanovo State University of Chemistry and Technology, Russia.

Research lines

In addition to various aspects of synthetic and supramolecular chemistry his current research interests include the preparation and study of photophysical properties of organic functional materials. His group is currently exploring several areas of application of phthalocyanines, porphyrins and carbon nanostructures (carbon nanotubes, graphene), including organic and hybrid solar cells, with a focus on nanotechnology.

Relevant publications

- "Linking Photo- and Redoxactive Phthalocyanines Covalently to Graphene" M.-E. Ragoussi, *et col.* *Angew. Chem. Int. Ed.* 2012, **51,** 6421-6425
- "Carboxyethynyl Anchoring Ligands: A Means to Improve the Efficiency of Phthalocyanine-Sensitized Solar Cells" M.-E. Ragoussi, *et col.* *Angew. Chem. Int. Ed. Eng.* 2012, **51,** 4375-4378
- "Towards tunable graphene / phthalocyanine-PPV hybrid systems" Jenny Malig, *et col.* *Angew. Chem. Int. Ed.* 2011, **15,** 3561-3565

Olga Trukhina

Ph.D. student

Electrochemical Biosensors

Prof. María Encarnación Lorenzo

Associated Senior Scientist
Ph.D.: Universidad Autónoma de Madrid, Spain
Double Affiliation: Universidad Autónoma de Madrid, Spain

María Encarnación Lorenzo graduated in Analytical Chemistry in 1979 at the Universidad Autonoma de Madrid (UAM). She received her PhD in 1985 at the same University and then moved to the University of Dublin and the University of Cornell (USA). She is currently full professor of Analytical Chemistry at the University Autónoma of Madrid and the coordinator of Sensor and Biosensors Group Professor Lorenzo's research interests is focused on the developed very selective biosensors for rapid determination of important analytes

Research lines

- Interaction of (Bio)molecules with nanomaterials: Characterization and properties.
- Use of nanomaterial in the development of improved bioanalytical devices.
- Surface Science: Characterization of biological nanomaterials immobilized on metallic surfaces.
- Development of nanoscale oscillators to design optoelectronic materials for optical data storage media, photochemical energy conversion and for bioelectronic applications.

Relevant Publications

- "Interactions of Schiff-base ligands with gold nanoparticles: structural, optical and electrocatalytic studies" Jose María Abad, *et col.* *Phys. Chem. Chem. Phys.* **13**, 5668-5678 (2011)
- "Dual-Stage DNA Sensing: Recognition and Detection" T. García *et col.* *Anal. Chem.* **80**, 9443- 9449 (2008)
- "Thiol-Functionalized Gold Surfaces as a Strategy to Induce Order in Membrane-Bound Enzyme Immobilization" Casero, E. *et col.* *Nano Lett.* 2002, **2**, 577-582

programme 1
molecular nanoscience

Time resolved Optical Spectroscopy

Optical spectroscopy of polyconjugated materials

Prof. Johannes Gierschner
Senior Researcher
Ph.D.: University of Tübingen, Germany
Previous Position: University of Mons, Belgium

Johannes Gierschner received his PhD in 2000 in Tübingen (Germany), followed by a position as researcher, lecturer, and institute manager in equal shares. In 2004 he moved to Mons (Belgium) with D. Beljonne & J. Cornil, including a 4-month stay with J.-L. Brédas at GeorgiaTech. In 2008 he became Ramón y Cajal research fellow and Senior Researcher at IMDEA Nanoscience. He was visiting researcher in Valencia (2008-10) and holds regular visiting researcher positions in Tübingen and Seoul National University. JG has coordinated National and European projects and has published more than 70 peer-reviewed papers (1900 cites, h = 25).

Research lines

JG's work integrates steady-state and time-resolved optical spectroscopy with quantum-chemical methods to achieve an in-depth understanding of the signatures and fates of excitons in organic materials for optoelectronic applications, with special focus on environmental effects in polymers (including aggregation, disorder, temperature, etc), single crystals of structurally well-defined oligomers and supramolecular nanostructured multi-chromophore systems.

Relevant publications

- "Stimulated Resonance Raman Scattering and Lasing Oscillation in Highly Emissive Distyrylbenzene Based Molecular Crystals", S. Varghese et col, *Adv. Mater.* **24** (2012) 6473-6478.
- "Multi-Stimuli Two-Color Luminescence Switching via Different Slip-Stacking of Highly Fluorescent Molecular Sheets, S.-J. Yoon" et col, *J. Am. Chem. Soc.* **132** (2010) 13675–13683.
- "Three-Dimensional Energy Transport in Highly Luminescent Host-Guest Crystals: A Quantitative Experimental and Theoretical Study", L. Poulsen et col, *J. Am. Chem. Soc.* **129** (2007) 8585-8593.

Dr. Aránzazu Aguirre
(until June 2012)
Postdoc
Technical University Eindhoven, Holland

Dr. Shinto Varghese
Postdoc
National Institute for Interdisciplinary Science and Technology, Kerala, India

Femtosecond spectroscopy on molecular systems

Prof. Larry Luer

Senior Researcher
Ph.D.: University of Tübingen, Germany
Previous Position: Politecnico di Milano, Italy

Larry Luer (born in Leutkirch / Germany in 1965) received his PhD at the University of Tübingen in 2001, studying the photoconductivity of organic conjugated molecules. In 2001/2002, he held a Marie Curie Individual fellowship at Politecnico di Milano in the group of Guglielmo Lanzani, investigating ultrafast charge carrier generation in organic conjugated molecules. From 2003-2009, he was senior researcher at Politecnico di Milano, focused on ultrafast events in low dimensional conjugated materials, such as carbon nanotubes and purple bacterial light harvesting systems. Since 2009, he is Senior researcher at IMDEA nanociencia. He has coordinated the Marie Curie Network "BIMORE" and is now member of the Marie Curie Network "ESTABLIS".

Research lines

- Vectorial energy transfer in purple bacterial light harvesting systems
- Ultrafast charge and energy transfer in Carbon nanotubes
- Environmental stability of organic photovoltaic systems
- Photophysical characterization of novel materials for organic photovoltaics.

Relevant publications

- "Free-carrier generation in semiconducting single-wall carbon nanotube aggregates" J. J. Crochet, *et col. Phys. Rev. Lett.* **107**, 257402, 1-5 (2011)
- "Photodegradation of P3HT - a systematic study of environmental factors", H. Hintz, *et col. Chem. Mater.* **23**, 145-154 (2011)
- "Low Light Adaptation: Energy Transfer Processes in Different Types of Light Harvesting Complexes from Rhodopseudomonas palustris" V. Moulisova, *et col. Biophys. J.* **97**, 3019-3028 (2009)

Safakath Karuthedath

Ph.D. student

Pump probe and photoinduced absoption spectroscopies

Dr. Juan Cabanillas-González

Researcher
Ph.D.: Imperial College London, UK
Previous Position: Politecnico di Milano, Italy

Juan Cabanillas González got a degree in Physics at Universidade de Santiago de Compostela in 1999. In 2004 he completed a PhD at Imperial College London working with photophysics of ?-conjugated polymer-based blends for photovoltaic applications. Between 2003-2006 he worked as post-doc at Politecnico di Milano with electric field assisted pump-probe spectroscopy. Between 2006-2009 he held a research fellowship to investigate the use of electromodulated spectroscopy coupled to confocal microscopy for charge density mapping in organic planar photodetectors. Since 2009 he is Ramon y Cajal researcher at IMDEA Nanociencia.

Research lines

- Processes: Charge generation/recombination, charge transport, exciton dynamics, optical gain, morphology.
- Materials: π-conjugated polymers and oligomers, hybrid inorganic-organic semiconductors, colloidal semiconductors.
- Techniques: Time-resolved spectroscopy (pump –probe, transient absorption, time resolved fluorescence), electromodulated spectroscopy (CW and transient Stark), OLED and solar cell characterization, optical gain characterization.

Relevant publications

- "Role of amorphous and aggregate phases on field-induced exciton dissociation in a conjugated polymer", Marta M. Mróz *et col. Phys. Review B* **87,** 035201 (2013).
- "Pump-Probe Spectroscopy in Organic Semiconductors: Monitoring Fundamental Processes of Relevance in Optoelectronics" J. Cabanillas-Gonzalez *et col. Adv. Mat.* **23,** 5468 (2011).
- "Photoinduced transient stark spectroscopy in organic semiconductors: A method for charge mobility determination in the picosecond regime", J. Cabanillas-Gonzalez *et col. Phys. Rev. Lett.* **96,** 106601 (2006).

Dr. Marta Magdalena Mroz

Postdoc
Politecnico di Milano, Italy

Longfei Wu

Ph.D. student

Gonzalo del Pozo

Research Assistant

Computational Design and Analysis of Novel π-Conjugated Materials

Dr. Begoña Milián
Researcher
Ph.D.: Universidad de Valencia, Spain
Previous Position: ICMOL, Universidad de Valencia, Valencia, Spain

Dr. Milián received a European PhD in 2004 at the University of Valencia (UV) Spain. After that, she joined the group of J. Cornil and D. Beljonne at the University of Mons, Belgium, for a postdoctoral stay. From 2008 to 2010 she held a Juan de la Cierva research position at ICMOL (UV) in the group of E. Ortí. Since January 2011 she holds a Junior Researcher position at IMDEA Nanociencia, Madrid. The intense collaborations with theoretical and experimental groups in Europe, USA, Canada and Korea include research stays with J.L. Brédas (USA) and S.Y. Park (Korea). (Co-)author of 23 articles (365 cites, h=12). Currently, she is the president of the group of Young Chemist Researchers of the Spanish Royal Society of Chemistry (RSEQ). http://www.rseq.org/jiq.htm

Research lines

Quantum-chemical description of intra- and intermolecular contributions of the geometric, electronic, optical and photophysical properties of organic and metallorganic conjugated compounds, using semiempirical methods (AM1, ZINDO/S), density functional theory [(TD)DFT], and *ab initio* methods (HF, CIS, MP2, CASPT2, CCSD...).

Relevant publications

- "Excited-State Switching by Per-fluorination of Para-oligophenylenes" B. Milián-Medina, *et col.* *J. Chem. Phys.* 135 (2011) 1245091-1245096
- "White-Light-Emitting Molecule: Frustrated Energy Transfer between Constituent Emitting Centers" Sanghyuk Park, *et col.* *J. Am. Chem. Soc.* **131** (2009) 14043 -14049
- "Effect of Fluorination on the Electronic levels and Optical Excitations of π-Conjugated Oligomers" B. Milián, *et col.* *J. Chem. Phys.* **126**, 1111011-1111016 (2007)

programme 2
scanning probe microscopies and surfaces

The use of advanced microscopies and spectroscopies with atomic resolution is essential to characterize matter at the nanoscale. The scientists involved in this programme develop advanced Scanning Probe Microscopes, mostly STM, AFM and Photoelectron Microscopy to investigate problems such as the epitaxial growth of graphene, the self-assembly of molecules at surfaces, the realization of inelastic spectroscopy at the level of single molecules or the spin polarized imaging of magnetic nanostructures. Friction at the nanoscale and theoretical modelling are also involved. Activities of this programme have implications for aeronautics and energy applications and closely interact with the ones of Programmes 1 and 3.

Prof. Rodolfo Miranda

Programme Manager

Double Affiliation: Universidad Autónoma de Msdrid, Spain

Rodolfo Miranda got his Ph.D in Physics from the Universidad Autónoma de Madrid (UAM) in 1981 for a work on the role of defects on surfaces supervised by Prof. J.M. Rojo. He worked in Munich and Berlin with Gerhard Ertl (NL in Chemistry 2007), before being appointed Full Professor of Condensed Matter Physics at the UAM in 1990.

Prof. Miranda has been Vice-chancellor of Research and Scientific Policy (1998-2002) of the UAM, Executive Secretary of the R+D Commission of the Conference of Rectors of Spanish Universities (CRUE) (2000-2002) and Director of the Materials Science Institute "Nicolás Cabrera".

Professor Miranda has authored and coauthored more than 220 scientific publications, which have received nearly 6.000 citations. He has supervised more than 40 Ph. Ds and postdoctoral researchers. Together with his collaborators, Prof. Miranda has developed instruments to perform Scanning Tunnelling Microscopy (STM), Helium Atom Scattering (HAS) or Angular Resolved Photoemission (ARUPS) in Ultra High Vacuum conditions. He has served on Advisory Committees for different institutions, such as the Surface Science Division of IUVSTA, the Max Planck Institute für Mikrostruktur Physik, Halle, or the European Synchrotron Radiation Facility (ESRF) at Grenoble. Prof. Miranda is Fellow of the American Physical Society, Head of the Surface Science Lab of the UAM (LASUAM) and Director of the Madrid Institute for Advanced Studies in Nanoscience (IMDEA-Nanociencia). He is Director of IMDEA-Nanociencia from February 2007.

Relevant publications

- "Determination of Surface Topography of Biological Specimens at high Resolution by Scanning Tunneling Microscopy". A.M. Baró, *et col.* *Nature* **315**, 253-254 (l985)
- "Surfactant-induced Suppression of Twin Formation During Growth of fcc Co-Cu Superlattices on Cu(111)" J. Camarero, *et col.* *Phys. Rev. Lett.* **73**, 2448, 1-6 (1994)
- "Curie Temperature of Ultrathin Films of fcc-Cobalt Epitaxially Grown on Atomically Flat Cu(100) Surface". C.M. Schneider, P. Bressler, P. Schuster, J. Kirschner, J.J. de Miguel and R. Miranda *Phys. Rev. Lett.* **64**, 1059, 1-4 (1990)

Nanotribology

Prof. Enrico Gnecco

Senior Researcher

Ph.D.: University of Genova, Italy

Previous Position: University of Basel, Switzerland

Enrico Gnecco received his PhD in Physics from the University of Genova in 2001, and worked several years at the University of Basel before joining IMDEA Nanociencia in 2010. Among other topics, he investigated atomic-scale friction of metal, insulating and semiconducting surfaces in ultra-high vacuum, the onset of abrasive wear on crystal surfaces on the nanoscale, the transition from stick-slip to superlubricity, the phononic and electronic contributions to dissipation in close proximity to solid surfaces, and the confinement of organic molecules on insulating surfaces caused by artificial nanostructures. Enrico Gnecco coauthored about 65 peer-reviewed articles (h-index 16), one book and various book chapters.

Research lines

At IMDEA Nanociencia Prof. Gnecco is leading the nanotribology group, focusing on friction, adhesion and wear processes on the nanometer scale. Both experimental (atomic force microscopy and related techniques) and theoretical (analytical models based on classical mechanics and reaction rate theory) approaches are explored. Our current research topics are friction in liquid environments, nanomanipulation of organic molecules, and nanostructuring of polymers caused by visco-plastic deformations.

The ultimate goal of his work is to control friction and particle manipulation at the nanoscale.

Relevant Publications:

- "Suppression of electronic friction on Nb films in the superconducting state" M. Kisiel, *et col.* *Nature Materials* **10** ,119-122 (2011)
- "Atomic-scale control of friction by actuation of nanometer-sized contacts" Socoliuc, *et col.* *Science* **313** 207-210 (2006)
- "Velocity dependence of atomic friction" E. Gnecco, *et col.* *Phys. Rev. Lett.* ***84***, 1172, 1-4 (2000)

Dr. Pawel Nita

Postdoc

Maria Curie-Sklodowska University, Lublin, Poland

Carlos Pimentel

Internship

Spin-Polarized STM

Dr. Fabián Calleja

Researcher

Ph.D.: Universidad Autónoma de Madrid, Spain

Previous Position: École Polytechnique Fédérale de Lausanne (EPFL), Switzerland

Fabian Calleja got his Ph. D. from the Universidad Autónoma of Madrid (UAM) in October 2007 with a work on the development of variable temperature STM. After his PhD, Dr. Calleja worked as a post-doctoral researcher in the group of Prof. Harald Brune in the Laboratory of Nanostructures at Surfaces (LNS) of the Institute of Condensed Matter Physics (ICMP) at the Federal Politechnical School of Lausanne (EPFL) from April 2008 to December 2010. Since January 2011 he is a Junior Researcher at IMDEA Nanociencia.

Research lines

Study of the electronic and magnetic properties of very small systems, ranging from single atoms or molecules to clusters of arbitrary size up to complete monolayers supported on different substrates. The experimental technique employed is the Spin-polarized Scanning Tunneling Microscopy (SP-STM) performed under Ultra High Vacuum (UHV) conditions.

Relevant publications

- "Periodically Rippled Graphene: Growth and spatially Resolved Electronic Structure" A. L. Vázquez de Parga, *et col.* *Phys. Rev. Lett.* **100**, 056807, 1-4 (2008)
- "Real-space Direct Visualization of the Layer-Dependent Roughening Transition in Nanometer-Thick Pb Films" Fabian Calleja, *et col.* *Phys. Rev. Lett.* **97**, 186104, 1-4 (2006)
- "Contrast Reversal and Shape Changes of Atomic Adsorbates Measured with Scanning Tunnelling Microscopy" Fabian Calleja, *et col.* *Phys. Rev. Lett.* **92**, 206101, 1-4 (2004)

Flavio Pendolini

Ph.D. student

MBE growth of magnetic and organic thin films and nanostructures. Photoelectron Microscopy

Dr. Miguel Angel Niño

Researcher

Ph.D.: Universidad Autónoma de Madrid, Spain.

Previous Position: Elettra Synchrotron Radiation Facility (Trieste), Italy.

Miguel Angel Niño received his PhD at Universidad Autónoma de Madrid working on magnetic self organized nanostructures and metastable alloys. Then he joined the X-ray Microscopy group of A. Locatelli and M. Kiskinova at Elettra Synchrotron (Italy) as postdoctoral fellow, and after as beamline scientist, performing Photoemission Electron Microscopy and Low Energy Electron Microscopy applied to growth and characterization of magnetic thin films and nanostructures. With more than 45 publications in international journals and more than 70 communications at international congresses, he joined IMDEA Nanoscience in 2011.

Research lines

- Characterization of nanostructures and nanoparticles on surfaces with X ray techniques and photoelectron microscopy.
- MBE growth of thin films with applications in magnetic systems: control of magnetoresistance and magnetic anisotropy through atomic interface design and electric fields.
- Hybrid molecular-magnetic structures: organic spin valves, molecular magnets, chiral molecules on surfaces.
- MBE growth of organic solar cells.

Relevant publications

- "Domain Wall Depinning Assisted by Pure Spin Currents" Ilgaz D, *et col.* *Phys. Rev. Lett.* **105,** 076601, 1-4 (2010)
- "Magnetization and structure of ultrathin Fe films" R. Zdyb, *et col.* *Phys. Rev.* B **80**, 184425, 1-9 (2009)
- "Surfactant-Assisted Epitaxial Growth and Magnetism of Fe Films on Cu(111)" M.A. Niño, *et al.* *J. Phys.: Condens. Matter* **20** (2008) 265008-265015

Dr. Cristina Navío

Postdoc

Mons University, Belgium

Graphene growth and spectroscopy with low-T STM

Prof. A. L. Vázquez de Parga

Associated Senior Scientist

Ph.D.: Universidad Autónoma de Madrid, Spain

Double Affiliation: Universidad Autónoma de Madrid, Spain

Amadeo L. Vázquez de Parga got his PhD in 1992 at the Universidad Autonoma de Madrid (UAM). Construction of a Scanning Tunneling Microscope (STM) working in ultra high vacuum, the first in Spain. He carried out a postdoc stay at IBM Research Laboratory in Rüschlikon (Switzerland) in photoluminescence excited by the STM. From 1999 Prof. Vázquez de Parga is Associate Professor in Condensed Matter Physics at the UAM and from 2008 Associated Senior Researcher at IMDEA-Nanoscience.

2002-2003 visiting researcher at the Radboud University, Nijmegen (The Netherlands), working on spin polarized STM

Short research stays at Lawrence Berkeley Laboratory, California (1990), Max Planck Institute in Halle (Germany) (2000) and at University of Gakushuin, Tokio (Japan) (2004)

Research lines

Currently we are working on graphene grown on different transition metals studying the crystallographic and electronic properties. Graphene is also used as substrate for molecular deposition. We are currently doing spin polarized STM measurements on molecules deposited on magnetic substrates. Another research line is the study of molecular self-assembly on metallic surfaces. The main techniques are scanning tunneling microscopy and spectroscopy, Low energy electron diffraction, Auger spectroscopy and X-ray photoelectron spectroscopy.

Relevant publications

- "Periodically rippled graphene: Growth and spatially resolved electronic structure" A.L. Vázquez de Parga, *et col.* *Phys. Rev. Lett.* **100**, 056807, 1-5 (2008)
- "Atomistic mechanism of surfactant-assisted epitaxial growth" J. Camarero, *et col.* *Phys. Rev. Lett.* **81**, 850, 1-4 (1998)
- "Observation of preferred heights in Pb nanoislands: A quantum size effect" A.L. Vázquez de Parga, *et col.* *Phys. Rev.* B **66**, 115401, 1-6 (2002)

Dr. Koen Lauwaet

Postdoc

K Leuven University, Belgium

Manuela Garnica

Ph. D. student

Sara Barja

Ph. D. student

Mohammadreza Azani

Internship

Azin Hassanpour

Internship

Modelling physical properties of nanostructures

Prof. Fernando Martín

Associated Senior Scientist
Ph.D.: Universidad Autónoma de Madrid, Spain
Double Affiliation: Universidad Autónoma de Madrid, Spain

Fernando Martín graduated in Quantum Chemistry in 1984 and in Theoretical Physics in 1986 at the Universidad Autonoma de Madrid (UAM). He received his PhD in 1986 at the same University and then moved to the University of Bordeaux, the University of Paris VI and the University of Chicago. He is currently Full Professor at UAM and Senior Research Associate at IMDEA. He is also the coordinator of the European COST Action "Chemistry with ultrashort pulses and free electron laser".

Research lines

- Attophysics: Control of electron dynamics with ultrashort pulses and free electron lasers.
- Surface science: Molecular self-assembly and reactivity on metal surfaces and graphene.
- Nanoscience: Structure and properties of fullerenes and nanoparticles.

Relevant Publications

- "Electron localization following attosecond molecular photoionization" G. Sansone, *et col. Nature* **465** 763- 766 (2010)
- "Single photon induced symmetry breaking of H_2 dissociation" F. Martín *et col. Science* **315**, 629-630 (2007)
- "Complete photo-induced breakup of the H_2 molecule as a probe of molecular electron correlation" W. Vanroose, *et col. Science* **310**, 1787-1789 (2005)

Dr. Yang Wang

Postdoc
Universidad Autónoma de Madrid, Spain

Daniele Stradi

Ph. D. student

Atomic and molecular self-assembly at surfaces

Dr. Roberto Otero

Associated Scientist
Ph.D.: Universidad Autónoma de Madrid, Spain
Double Affiliation: Universidad Autónoma de Madrid, Spain

Dr. Roberto Otero received his Ph.D. degree from Universidad Autónoma de Madrid in 2002 under the supervision of Prof. Rodolfo Miranda, working on the relations between the electronic structure and the morphology of inorganic nanostructures. He then moved to the University of Aarhus, Denmark, where he joined the group of Prof. Flemming Besenbacher as a postdoctoral assistant. There, he got involved in the research about the self-assembly of organic molecules on solid surfaces by Variable-Temperature, Fast-Scanning Tunneling Microscopy. He is presently associated Researcher at IMDEA Nanoscience.

Research lines

The current scientific interest of Dr. Roberto Otero focus on the structural and chemical characterization of the interfaces between metals and organic materials, interfaces which are important for the performance of many organic electronic, optoelectronic and photovoltaic devices. For carrying out such studies, Dr. Roberto Otero uses an optimized experimental system that combines X-Ray Photoelectron Spectroscopy (XPS) and Variable-Temperature Scanning Tunneling Microscopy (VT-STM).

Relevant publications

- "Elementary Structural Motifs in a Random Network of Cytosine Adsorbed on a Gold(111) Surface" Roberto Otero, *et col. Science* **319**, 312-315 (2008)
- "Guanine Quartet Networks Stabilized by Cooperative Hydrogen Bonds" Roberto Otero, *et col. Angew. Chem. Int. Ed.* 2005, **44**, 2270-2275
- "Lock-and-Key Effect on the Surface Diffusion of Large Organic Molecules Probed by STM" Roberto Otero, *et col. Nature Materials* **3**, 779-782 (2004)

Fabiola Iacono

Ph. D. student

Jonathan Rodríguez

Ph. D. student

Physics of surfaces and thin films

Prof. José María Gallego

Associated Scientist

Ph.D.: Universidad Autónoma de Madrid, Spain

Double Affiliation: Instituto de Ciencia de Materiales de Madrid - CSIC

José Maria Gallego received his B.S. degree in physics from the Universidad Autonoma de Madrid in 1986 and completed his Ph.D. in 1991 with Prof. Rodolfo Miranda. He continued his post-doctoral studies with Prof. Ivan K. Schuller at the University of California in San Diego, before joining the Spanish Consejo Superior de Investigaciones Científicas (CSIC) in 1996 as a tenured scientist. In December 2010 he joined IMDEA-Nanociencia as an Associated Researcher.

Research lines

His research interest is centered on the physics of surfaces and thin films, in particular in scanning tunneling microscopy and electron spectroscopy studies of epitaxial growth, in ultrahigh vacuum conditions, of both organic and inorganic materials on solid surfaces.

Relevant Publications:

- "An Organic Donor/Acceptor Lateral Superlattice at the Nanoscale" Otero, Roberto, *et col*. *Nano Lett.* **7**, 2602-2607 (2007).
- "Atomistic Mechanism of Surfactant-Assisted Epitaxial Growth" G. Rosenfeld, *et col.* *Phys. Rev. Lett.* **81**, 850, 1-4 (1998).
- "Influence of the Growth Conditions on the Magnetic Properties of fcc Cobalt Films:from Monolayers to Superlattices" J.J. de Miguel, *et col.* *Journal of Magnetism and Magnetic Materials* **93**, 1-9 (1991)

Luigi Terraciano

Ph. D. student

programme 3
nanomagnetism

This Programme deals with the preparation and characterization of Advanced Magnetic Nanomaterials and explores some of their biomedical applications. The materials, both inorganic and organic, are grown by Molecular Beam Epitaxy (MBE) in ultra-high vacuum environment, by sputtering or by chemical synthesis. They are ultrathin films, superlattices, or nanoparticles and their magnetic properties are characterized by morphological, structural, electronic, and (mostly optical) Magnetometry techniques. Additionally, large scale experimental facilities (i.e., synchrotron, neutron, or ion-accelerator sources) are often used to elucidate some fundamental aspects. Particular emphasis is placed on magnetization reversal processes of low-dimensional artificial magnetic structures. The preparation and characterization of magnetic nanoparticles for use in Nanobiomedicine has recently emerged as an important research line in this Programme with the aim to develop ultrasensitive NMR molecular imaging agents, magnetic carriers for in vivo targeting of therapeutic compounds or hyperthermia treatment of cancer. Appropriate theoretical modelling also plays a role in the Programme.

Growth and characterization of magnetic nanomaterials

Prof. Julio Camarero
Associated Senior Scientist
Ph.D.: Universidad Autónoma de Madrid, Spain
Double Affiliation: Universidad Autónoma de Madrid, Spain

Julio Camarero received his PhD in physics from the Universidad Autónoma de Madrid in 1999. He then worked at Institut Néel-CNRS France (Marie-Curie Fellow and scientific contracts) before returning to UAM in 2003 as Ramón y Cajal research fellow. He is currently Associate Professor of the Condensed Matter Physics Department and Secretary of the Institute of Materials Science "Nicolás Cabrera". In 2008 he joined the Nanomagnetism Group at IMDEA Nanoscience as Associated Senior Scientist.

He has published more than 60 regular papers (> 950 cites, *h*-index: 16), 9 book chapters, 4 invited papers, and 1 EU patent. 20 invited talks at international conferences (150 other conference presentations). Dr. Camarero is a frequently invited scientist in different Synchrotron Radiation Facilities (60 weeks).

Research lines

Currently, his goal is to acquire a better understanding of the fundamental physics of new functional properties that are important, or may become important, for applications in Spintronics and Biomedicine areas.

His main scientific interests are: development of new hybrid (inorganic-organic) magnetic nanostructures, magnetization reversal processes, polarization dependent x-ray spectroscopy and microscopy, sub-nanosecond and element resolved magnetization reversal dynamics, nanomagnetism and biomedicine.

Relevant Publications

- "Origin of the asymmetric magnetization reversal behavior in exchange-biased systems: Competing anisotropies" J. Camarero, *et col. Phys. Rev. Lett.* **95**, 057204, 1-4 (2005)
- "Perpendicular interlayer coupling in FeNi/NiO/Co trilayers" J. Camarero, *et col. Phys. Rev. Lett.* **91**, 02720, 1-5 (2003)
- "Surfactant-induced Suppression of Twin Formation During Growth of fcc Co-Cu Superlattices on Cu(111)". J. Camarero, *et col. Phys. Rev. Lett.* **73**, 2448, 1-6 (1994)

Spintronics and biomedical applications

Dr. Alberto Bollero

Researcher

Ph.D.: Technical University of Dresden, Germany

Previous Position: CIEMAT, Spain

Alberto Bollero got a B.Sc degree from the *Universidad Complutense de Madrid*. He was a PhD student at the *IFW-Dresden,* working on nanocrystalline magnetic materials and got his PhD degree at the *Technical University of Dresden* in 2003. He has been Postdoctoral at the *University of Leipzig,* studying magnetic and magnetotransport properties of thin films, and Marie Curie Fellow at *SPINTEC (CEA-Grenoble)* on exchange bias systems for magnetic applications. Dr. Bollero was researcher at *CIEMAT-Madrid*: on photovoltaic applications and solar control coatings for architectural applications. Since 2010 he is "Ramón y Cajal" Fellow at *IMDEA-Nanociencia*.

Research lines

- Magnetic nanostructures for spintronics. Miniaturization of magnetic multilayered devices for technological applications in magnetic sensors based on spin valves and magnetic tunnel junctions. Magnetization reversal mechanisms and thermal stability.
- Magnetic nanoparticles with biomedical applications. Dynamic magnetic properties of nanoparticles for cancer therapeutic applications.

Relevant Publications

- "Enhanced exchange bias effects in a nano-patterned system consisting of two perpendicularly-coupled ferromagnets", A. Bollero, *et col. Appl. Phys. Lett.* **92**, 022508, 1-3 (2008)
- "Magnetoresistance switch-effect in a multiferroic Fe3O4/BaTiO3 bilayer", M. Ziese, *et col. Appl. Phys. Lett.* **88**, 212502, 1-3 (2006)
- "*Out-of-plane exchange bias properties of [Pt/Co]-IrMn bilayers sputtered on pre-patterned nanostructures"*A. Bollero, *et col. Appl. Phys. Lett.* **89**, 152502, 1-4 (2006)

Dr. Nikolai Mikuszeit

Postdoc

Institute of Applied Physics, University of Hamburg, Germany

Erika Jiménez

Ph. D. student

José Luis Fernández

Ph. D. student

Cecilia Rodrigo

Ph. D. student

Francisco Javier Pedrosa

Ph. D. student

Growth & nanostructuring. magneto-electric thin films

Dr. Feng Luo

Researcher

Ph.D.: Peking University, China

Previous Position: Peking University, China

Feng Luo got his PhD in Materials Chemistry at the College of Chemistry and Molecular Engineering, Peking University in 2004. Then he worked as a postdoc in the Max-Planck-Institute for Microstructure Physics (Germany) and in the Laboratory for Micro- and Nanotechnology from the Paul Scherrer Institut (Switzerland) until Oct. 2009. From 11/2009-11/2010, he was appointed as a principal investigator in the College of Engineering at Peking University. Since 12/2010 he works at IMDEA-Nanoscience (Madrid) studying inorganic/organic hybrid magnetic nanostructures and magnetio-electric thin film devices with applications in spintronics.

Research lines

Tuning magnetic and electric properties of multifunctional materials by designing and controlling interfaces at atomic scale, including interfaces of magnetic nanostructures, magneto-elastic-electric multifunctional thin film composites and hybrid ferromagnetic/organic interface of Molecular spintronics; Investigation of multifunctional magneto-electric devices by micro and nanofabrication techniques.

Relevant Publications

- "Strongly enhanced orbital moment by reduced lattice symmetry and varying composition of $Fe_{1-x}Co_x$ alloy films" Fikret Yildiz, *et col. Phys. Rev. Lett.* **100**, 037205, 1-4 (2008)
- "Tuning the perpendicular magnetic anisotropy in tetragonally distorted $Fe_{1-x}Co_x$ alloy films on Rh (001) by varying the alloy composition" Feng Luo, *et col. Appl. Phys. Lett.* **91**, 262512, 1-3 (2007)
- "Tuning negative and positive magnetoresistances by variation of spin-polarized electron transfer into p-conjugated polymers" Feng Luo, *et col. Appl. Phys. Lett.* **84,** 1719, 1-4 (2004)

Dr. Paolo Perna

Postdoc

CNR-INFM CRS Coherentia, Naples, Italy

Davide Maccariello

Ph. D. student

Hauyu Feng

Ph. D. student

Magnetic nanoparticles in biomedical applications

Dr. Francisco Terán

Researcher

Ph.D.: Université Joseph Fourier-Grenoble I, France

Previous Position: Centro Tecnologico Gaiker. Fundación Gaiker. Spain

Graduated in Physics from the Universidad Autónoma de Madrid in 1997, Francisco Terán got a Ph.D. in Physics from the Université Josep Fourier in 2001. Dr. Terán has performed research studies on spin and electronic properties of semimagnetic semiconductor nanostructures at different international research centers and joined the Nanomagnetism Programme of IMDEA Nanoscience on April 2009. Since then, Dr. Terán is interested on the dynamical magnetic properties of iron oxide nanoparticles for biomedical applications.

Dr. Terán has more than 40 publications in international journals, and more than 25 invited and oral communications at international conferences.

Research lines

- Magneto-thermal and magnetic properties of superparamagnetic nanoparticles for biomedical applications
- Stimuli responsive polymeric surfaces
- Spin dynamics in semi-magnetic semiconductor nanostructures
- Optical properties of semiconductor nanostructures

Relevant Publications

- "Controlled synthesis of uniform magnetite nanocrystals with high-quality properties for biomedical applications" G. Salas, *et al. J. Mater.Chem.* **22,** 21065 (2012)
- "Accurate determination of the speci?c absorption rate in superparamagnetic nanoparticles under non-adiabatic conditions" F.J. Teran, *et al. Appl. Phys. Lett.* **101,** 062413 (2012)
- "Collective character of spin excitations in a system of Mn2+ ions coupled to a two-dimensional electron gas" F.J.Teran, *et al. Phys. Rev. Lett.* **91,** 077201, 1-4 (2003)

Dr. Gorka Salas-Hernández

Postdoc

Laboratoire de Chimie Organométallique de Surface. Lyon, France

Dr. Sandra Milena Ocampo

Postdoc

Instituto de Química Avanzada de Cataluña (IQAC-CSIC) Barcelona, Spain

Cintia Casado

Research Assistant

Jesús García

Internship

Belén Cortés

Internship

Teresa Rincón

Internship

Magnetic nanoparticles in biomedicine. Cell-particle interactions

Prof. Ángeles Villanueva

Associated Senior Scientist

Ph.D.: Universidad Autónoma de Madrid, Spain

Double Affiliation: Universidad Autónoma de Madrid, Spain

Dr. Ángeles Villanueva is a cell biologist. Her research is mainly focused on photodynamic therapy of cancer. In the last years, she has established new collaborations with research groups in the field of magnetic nanoparticles with applications in Medicine. She has studied in cell cultures: i) the mechanisms of nanoparticles internalization; ii) their subcellular localization; iii) the nanoparticles biocompatibility; and iv) the identification the cell death mechanism induced by heat-controlled intracellular hyperthermia with magnetic nanoparticles and an alternating magnetic field.

Research lines

- Medical applications of nanoparticles. Cell cultures.
- Biocompatibilty of magnetic nanoparticles.
- Mechanisms of cell death.
- Alterations in adhesion and cytoskeletal proteins.
- Liposomal drug delivery.
- Evaluation in cell cultures and in vivo experimental models of new antitumor agents.
- Signaling pathways involved in cell death.

Relevant Publications

- "Photodynamic effects on culure tumor cells. Cytoskeleton alterations and cell death mechanisms" Villanueva A. et. col In *Handbook of Photochemistry and Photobiology.* ***Vol:*** **4,** pp: 79-117. 2003. (Ed. H. S. Nalwa). American Scientific Publisher. California, USA
- "Morphological criteria to distinguish cell death induced by apoptotic and necrotic treatments" Rello S., *et col. Apoptosis* **10**: 201-8, 2005
- "The influence of surface functionalization on the enhanced internalization of magnetic nanoparticles in cancer cells" Villanueva A., *et col. Nanotechnology* **20**: 115103-115111, 2009

Macarena Calero

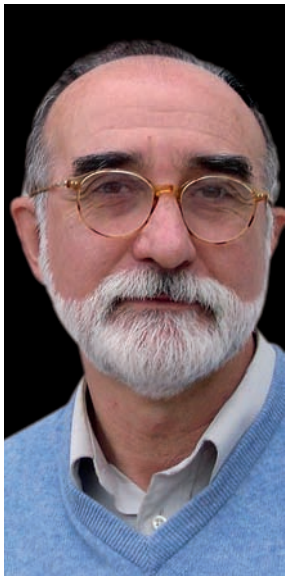
Ph.D. student

Ana Lázaro

Research Assistant

programme 4
nanobiosystems: biomachines and manipulation of macromolecules

This programme deals with the study of biological nanomachines, their assembly, structure and functional properties, as well as their interaction with defined substrates to build synthetic tools. In the area of Single molecule Analysis of Macromolecular Aggregates, there are groups working on protein engineering, computational chemistry, AFM analysis of macromolecular complexes, force spectroscopy analysis and manipulation of macromolecules and their aggregates, the study of nanomechanical properties of biological complexes of different complexities and optical trapping-based approaches to study the behavior of single biological nanomotors. Other systems under study are tailor-made polypeptides of increasing complexity designed to dissect relationships between molecular structure and functional properties. A second area of interest in this Programme is the organization of macromolecular complexes on well-defined substrates. Biological membranes, the protein folding and viral assembly pathways, the bacterial cytoskeleton and the DNA structure are examples of self-organizing systems under study with highly specialized functions and properties.



Prof. José L. Carrascosa
Programme Manager
Double Affiliation: Centro Nacional de Biotecnología CNB-CSIC, Spain

Prof. Carrascosa is Research Professor of the CSIC and Director of the Department of Structure of Macromolecules at the Centro Nacional de Biotecnología. He has been involved in the development of advanced microscopy methods for the structural analysis of biological material, with special emphasis in the study of different viral model systems. His activity has produced near 200 publications with an H index of 40. Prof. Carrascosa has carried out an extended international activity: President of the European Microscopy Society (2000-2004), member of the Executive Committee of the International Federation of Microscopy Societies (2010-2014), member of the Scientific Advisory Board of the European Synchrotron Radiation Facility (1995-1996: 2003-2005; 2006-2008), and Chairman of the Scientific Advisory Committee of ERA-Instruments (2008-2011), among others. He has been President of the Spanish Biophysical Society (2003-2007) and President of the Spanish Society of Cell Biology (1993-1996). Prof. Carrascosa is member of the editorial boards of the Journal of Structural Biology and Micron.

Relevant publications

- The structure of CCT-Hsc70(NBD) suggests a mechanism for Hsp70 delivery of substrates to the chaperonin Cuellar, J., Martin-Benito, J., Scheres, SHW., Sousa, R., Moro, F., Lopez-Vinas, E., Gomez-Puertas, P., Muga A., Carrascosa, J.L., Valpuesta, J.M. *Nature Structural & Molecular Biology*, **15**, 858-864 (2008)
- Maturation of phage T7 involves structural modification of both shell and inner core components. X. Agirrezabala, J. Martín-Benito, J.R. Castón, R. Miranda, J.M. Valpuesta and J.L. Carrascosa *EMBO Journal* **24**, 3820-3829 (2005)
- "Cryo-Electron Tomography of Vaccinia Virus" M. Cyrklaff, C. Risco, J. J. Fernández, M. V. Jiménez, M. Estéban, W. Baumeister and J. L. Carrascosa *Proc. Natl. Acad. Sci. USA* **102**, 2772-2777 (2005)

Protein engineering and biofunctional nanostructures

Prof. Aitziber L. Cortajarena

Senior Researcher
Ph.D.: Universidad del País Vasco, Spain
Previous Position: Yale University, USA

Dr. A.L.Cortajarena earned her Ph.D. in Biochemistry from the *Universidad del País Vasco* in 2002. Then, she joined the group of Dr. L. Regan at Yale University, USA, as a Postdoctoral Fellow. She worked on protein design, structure, and function. In 2006, she was Visiting Scientist at the Weizmann Institute, Israel, with Dr. G.Haran working on single molecule spectroscopy. Then, continued her work at Yale University, as an Associate Research Scientist with Dr. Regan. She joined IMDEA Nanociencia as Group Leader in January 2010. Her research focuses on protein design toward the application of novel proteins in nanobiotechnology.

Research lines

- Design recognition protein modules as tools in nanobiotechnology
- Self-assembly of designed proteins into tailored nanostructures
- Synthesis, characterization of helical repeat proteins for silicon nitride nanopores translocation studies
- Polymer surface bio-functionalization for biosensors applications
- Magnetic nanoparticles bio-functionalization for cancer treatment and therapy

Relevant publications

- "Calorimetric study of a series of designed repeat proteins: Modular structure and modular folding" Aitziber L. Cortajarena, and Lynne Regan. *Protein Science,* **20**, 336-340 (2011)
- "Designed protein modules to perturb cellular networks" Aitziber L. Cortajarena, *et col. ACS Chemical Biology,* **5**, 545-552 (2010)
- "Designed proteins as novel anti-cancer agents" Aitziber L. Cortajarena, *et col. ACS Chemical Biology* **3,** 161-166 (2008)

Dr. Pierre Couleaud

PostDoc
CNRS Nancy University, France

Sara Hernández

Internship

Optical nanomanipulation in molecular and cell biophysics

Dr. Ricardo Arias-González

Researcher
Ph.D.:Universidad Complutense de Madrid, Spain
Previous Position: Centro Nacional Biotecnología (CNB-CSIC), Madrid, Spain

Dr. Arias-González received both his Master Degree in Theoretical Physics in 1997 and his Ph.D. in 2002 from Complutense University in Madrid. During his Ph.D. research in the Materials Science Institute, Madrid, and short stays in École Centrale Paris and EMBL-Heidelberg, he developed theory and simulations to understand the electromagnetic field in nanoparticles. Then, he moved to U.C. Berkeley for his postdoctoral training, where he studied DNA with single molecule approaches. In 2006, he worked at the National Centre of Biotechnology, Madrid, where he developed a state-of-the-art optical tweezers. Since 2008, he has joined IMDEA Nanoscience, leading of the Optical Nanomanipulation Lab.

Research lines

Dr. Arias-González is working in the field of Molecular and Cell Biophysics, furthering the study of the macromolecules that make up the machinery of cells. His research lines cover three fundamental scale levels in Biology, namely, the molecule, the organelle and the cell. Specifically, his team investigates structural transitions of nucleic acids, molecular motors and electrophysiology of organelles from the single-molecule point of view. He is also interested in the development of biophysical techniques for these research purposes.

Relevant publications

- "Mechanical Identities of RNA and DNA Double Helices Unveiled at the Single-Molecule Level", E. Herrero-Galán, M.E. Fuentes-Pérez, C. Carrasco, J.M. Valpuesta, J.L. Carrascosa, F. Moreno-Herrero & J.R. Arias-González*, *J. Am. Chem. Soc.* **135,** 122-131 (2013).
- "Entropy Involved in Fidelity of DNA Replication". J.R. Arias-Gonzalez, *PLoS ONE* **7(8),** e42272 (2012).
- "Plasmon-Exciton Interactions on Single Thermoresponsive Platforms" S. Hormeño, N.G. Bastús, A. Pietsch, H. Weller, J.R. Arias-Gonzalez, and B.H. Juárez, *Nano Letters* **11,** 4742-4747 (2011).

Irene Gutiérrez

Internship

Modified oligonucleotides in nanobiomedicine: RNA interference and sensors

Dr. Álvaro Somoza

Researcher

Ph.D.: Universidad Autónoma de Madrid, Spain

Previous Position: Instituto de Investigaciones Biológicas (IRB-Barcelona), Barcelona. Spain

Álvaro Somoza studied Chemistry at Universidad Autónoma de Madrid where he did his PhD, under the direction of Prof. Carmen Carreño, focused on the total synthesis of Rubiginones. He then joined the group of Prof. Eric Kool at Stanford University. There he worked on a project focused on the use of modified oligonucleotides to study the role of sterics and hydrogen bonding interactions in RNA interference. Later, he moved to Barcelona to work with Dr. Ramón Eritja at the IRB, where he started a project devoted to the study of the interactions between RNA strands and the protein involved in RNA interference. He is junior scientist at IMDEA since 2009.

Research lines

The research of Dr. Somoza is focused on the preparation of modified oligonucleotides functionalization of nanoparticles for different applications. Particularly, modified RNAs are prepared to study RNA interference and to modify gold nanoparticles to improve their delivery. On the other hand, DNA is used to assemble nanostructures for different applications such as sensors.
In addition, gold and magnetic nanoparticles are modified with different linkers to ease their functionalization with different biomolecules or drugs for the treatment of cancer.

Relevant Publications

- "Protecting groups for RNA synthesis: an increasing need for selective preparative methods" Somoza, A. *Chem. Soc. Rev.* **37**, 2668-2675 (2008)
- "Steric effects in RNA interference: probing the influence of nucleobase size and shape" Somoza A., *et col. Chemistry Eur. J.* **14**, 7978-7987 (2008)
- "The Roles of Hydrogen Bonding and Sterics in RNA Interference Somoza, A., *et col. Angew. Chem. Int. Ed.* **45**, 4994-4997 (2006)

Dr. Alfonso Latorre

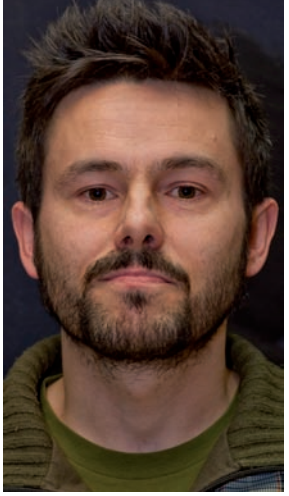
PostDoc

Universidad Autónoma de Madrid, Spain

Romina Lorca

Internship

Optical and magnetic tweezers



Dr. Borja Ibarra

Researcher

Ph.D.: Universidad Autónoma Madrid, Spain / CNB-CSIC Madrid, Spain

Previous Position: Centro Nacional Biotecnología (CNB-CSIC), Madrid, Spain

Borja Ibarra received his PhD. in Molecular Biology from the Universidad Autónoma de Madrid in 2001. He made the 'leap' to molecular biophysics as a postdoctoral fellow at University of California, Berkeley. There, he learned the techniques of single-molecule force spectroscopy and using optical tweezers he developed a single-molecule mechanical assay to study the dynamics of molecular motors involved in DNA replication. Back in Spain in 2007, he applied this technology at the CNB-CSIC to study biological molecular motors at single molecule level. He joined the Nanobiosystems research line at IMDEA Nanoscience in 2010.

Research lines

Many essential processes inside the cell involve mechanical tasks, which are carried out by specialized proteins called molecular motors. They are able to convert chemical energy into mechanical work at the molecular scale and therefore, present interesting biomedical and nanotechnological applications. In our laboratory we use single molecule manipulation techniques to understand the physical mechanism by which these molecular machines operate.

Relevant publications

- "Manipulation of single polymerase-DNA complexes: a mechanical view of DNA unwinding during replication." Morin JA *et al. Cell Cycle,* **11;** 2967-68 (2012)
- "Active DNA unwinding dynamics during processive DNA replication" J.A Morín *et al.* 2012 *Proc. Nat. Acad. Soc. USA* **109** 8115-8120
- "Proofreading Dynamics of a Processive DNA Polymerase" Ibarra, B. *et al. EMBO Journal* **28,** 2794-2802 (2009)

José Alberto Morín

PhD student

Super resolution Fluoresce Microscopy

Dr. Cristina Flors Ong

Researcher

Cristina Flors completed a PhD in Chemistry at the Institut Químic de Sarrià (Barcelona) in 2004 under the supervision of Prof. S. Nonell. In 2005 she moved to the laboratory of Prof. J. Hofkens at the Katholieke Universiteit Leuven (Belgium) to learn single-molecule and super-resolution fluorescence microscopy. In 2008 she began her independent research career at the University of Edinburgh, where she started a new research program to develop methodology for super-resolution imaging of DNA. In February 2012 she moved to IMDEA Nanoscience as a Researcher and Ramón y Cajal fellow.

Research lines

- Super-resolution fluorescence microscopy of DNA: We develop new imaging methods specifically tailored to DNA, which allow a spatial resolution of tens of nanometers.
- Genetically-encoded singlet oxygen photosensitizers: The objectives of this research line are to understand singlet oxygen photosensitization by proteins, engineer new and better mutants, and use them in applications such as photodynamic therapy or electron microscopy.

Relevant publications

- "Super-resolution fluorescence microscopy as a tool to study the nanoscale organization of the mitotic chromosome" C. Flors and W. C. Earnshaw *Curr. Opin. Chem. Biol.* 2011, **15,** 838-844.
- "Superresolution imaging of DNA labeled with intercalating cyanine dyes" C. Flors *et. al Chem Phys Chem* 2009, **10,** 2201—2204 (front cover)
- "Singlet oxygen photosensitization by EGFP and its chromophore HBDI", A. Jimenez-Banzo *et al. Biophys. J.* 2008, **94,** 168-172.

Proteins as tools in nanotechnology

Dr. Begoña Sot

Researcher

PhD.: Universidad del Pais Vasco, Spain

Previous Position: Centro Nacional Biotecnología (CNBCSIC), Madrid, Spain

Dr. Sot did her PhD in Universidad del Pais Vasco, under the supervision of Prof. Arturo Muga, focused on the allosterism of chaperons. Then she worked with Prof. Alan Fersht (Centre for Protein Engineering, Cambridge) gaining knowledge in biophysical characterization of protein-protein interactions. Later she worked with Prof. Alfred Wittinghofer (MPI, Dortmund) studying the activation of G-proteins activity by protein-protein interactions and its regulation by co-localization. In 2011 he joined Prof. Jose Maria Valpuesta`s group (CNB-CSIC), where she learned Electron Microscopy techniques. Finally, she joined IMDEA in December 2012 as Ramón y Cajal fellow.

Research lines

Use of proteins as tools in nanotechnology, specifically, protein engineering approaches for the design of new recognition modules and the development of nano-reactors with improved catalytic properties based on enzyme immobilization and co-localization.

Relevant publications

- "Ras GTPase activating (RasGAP) activity of the dual specificity GAP protein Rasal requires colocalization and C2 domain binding to lipid membranes". Sot B *et col.* 2013 *Proc. Nat. Acad. Soc.* USA **110,** 111-116
- "Unravelling the mechanism of dual-specificity GAPs". Sot B *et col. EMBO Journal* **29,** 1205-14 (2010)
- "Comparative biophysical characterization of the interaction of p53 with the pro-apoptotic BAK and the anti-apoptotic BCL-xL". Sot B *et col., J. Biol. Chem.* **282,** 29193-200 (2007)

AFM / Fluorescence microscopy of biomembranes

Prof. Marisela Vélez

Associated Senior Scientist
Ph.D.: University of Michigan, USA
Double Affiliation: Instituto de Catálisis CSIC, Madrid. Spain

Degree in Biology (biochemistry) Autonomus Universtity of Madrid (June 1982). Doctor of Philosophy (Ph.D): Biophysics. University of Michigan (USA) (August 1989). Dr. Vélez returned to Spain to work on the application of time resolved fluorescence spectroscopy of membrane fluorescent probes at the Physical Chemistry Institute "Rocasolano" (CSIC). Dr. Vélez joined the Condensed Matter Department at the Universidad Autonoma de Madrid (UAM) to work on the application of AFM to the study of biological surfaces, and then the Insitituto de Catálisis y Petroleoquímica (CSIC) to work on the structural characterization and development of amperometric biosensors based on the controlled anchoring of redox proteins. In 2001 she returned to the UAM and started working on the structural and dynamic characterization of the membrane associated protein complexes involved in bacterial cell division. And since 2008 Dr. Velez is currently at the CSIC, at the Instituto de Catálisis y Petroleoquímica.

Research lines

Dr. Vélez´s main research interest is related to understanding biological processes that take place on biological surfaces. She has worked on reconstituting *in vitro* the initial stages of the bacterial division complex. Her approach is to characterize the structure and dynamics at the single molecule level of the polymerization process of the main participant, the bacterial cytoskeletal protein FtsZ. High resolution information of the surface polymerization process under different conditions is analysed theoretically to better understand the main protein-protein interactions governing the assembly process. She has more recently started a new research line related to the use of self assembling biological structures as biotemplates to organize inorganic gold or magnetic particles.

Relevant publications

- "The cooperative behavior of E. coli cell division protein FtsZ assembly involves the preferential cyclization of long single-stranded fibrils" J.M. González, *et col.* *Proc. Natl. Acad. Sci. USA* **102**, 1895-1900 (2005)
- "The bacteriophage ϕ29 head-tail connector imaged at high resolution with atomic force microscopy in buffer solution" Müller, D.J., *et col.* *EMBO Journal* **16**, 2547-2553 (1997)
- "Rotational mobility of clustered and non-clustered acetylcholine receptors on rat myotubes" Vélez, M., *et col.* *J. Cell. Biol.* **110**, 2049-2059 (1990)

Julian Daich

PhD student

Mechanical properties of proteins

Prof. Mariano Carrión

Associated Senior Scientist
Ph.D.: Universidad Autónoma de Madrid, Spain
Previous Position: Instituto Cajal-CSIC Madrid. Spain

Mariano Carrión-Vázquez studied biochemistry in the University of Valencia, obtaining his PhD in neurobiology in 1993 at the Universidad Autónoma de Madrid. With Prof. Julio Fernández focused later on protein nanomechanics, first as a postdoctoral student at the Mayo Clinic (Rochester, MN) and later as an assistant professor at the Columbia University (New York, NY). He developed the methodology of polyproteins as unequivocal single-molecule markers, which has allowed the later progress of the field. In his group at the Cajal Institute (CSIC) and IMDEA Nanoscience he focuses on the nanomechanics of proteins of the nervous system.

Research lines

General title: Protein nanomechanics

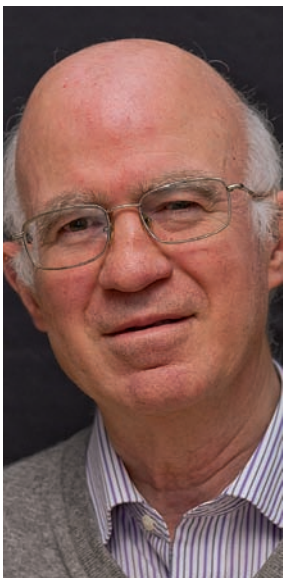
- Nanomechanics of proteins from the nervous system: cell adhesion proteins, membrane fusion proteins neurotoxic proteins, and scaffolding proteins.
- Nanomechanical analysis of bionanomachines from the nervous system: proteasome, chaperones and adhesion machinery.
- Development of force sensors for the nanomechanical analysis of proteins in vivo.
- Applications of nanomechanical analysis to proteomics.

Relevant publications

- "On the remarkable mechanostability of scaffoldins and the mechanical clamp motif" Valbuena A., *et col.* *Proc. Natl. Acad. Sci USA* **106,** 13791-13796 (2009)
- "The mechanical stability of ubiquitin is linkage dependent" Carrión-Vázquez, M., *et col.* *Nature Str. Biol.* **10,** 738-743 (2003)
- "Mechanical and chemical unfolding of a single protein: a comparison" Carrión-Vázquez, M., *et col.* *Proc. Natl. Acad. Sci. USA* **96,** 3694-3699 (1999)

programme 5
nanoelectronics and superconductivity

This program **mainly** deals with **Electric Transport in Nanosystems.** Alternative approaches to the silicon-based semiconductor industry may involve devices based on graphene nanostructures or transport through single molecules. Chemical synthesis to tailor molecular structure and functionality (in connection with Program 1), systematic variation of temperature and/ or vacuum conditions and theoretical computations are necessary complements to gain a wider perspective in molecular electronics. A second area of interest **is Superconducting Nanostructures,** i.e. mesoscopic superconductors fabricated as superlattices, nanowires or nanodots, where the way in which confinement and proximity phenomena between superconductors and materials with other properties (e.g. magnetic) **is explored**.



Prof. José Luis Vicent

Programme Manager
Double Affiliation: Universidad Complutense de Madrid, Spain

Jose Luis Vicent is professor of Physics in the Departamento de Física de Materiales (Universidad Complutense, Madrid) and Director of the Physical Techniques Center for Research Support (CAI Técnicas Físicas) of Universidad Complutense. Prof. Vicent has worked in the Physics Department at University of Virginia, F. Bitter National Magnet Lab. at MIT, Solid State and Materials Science Divisions at Argonne National Lab., Department of Physics at University California-San Diego, Centro Atómico Bariloche (Argentina), and Universidad del Valle (Colombia). He is Fellow of the American Physical Society, and member of the Royal Spanish Physical Society (RSEF), he has been secretary of its Publication committee, and Chairman of the Spanish Condensed Matter Division (RSEF, Real Sociedad Española de Fisica). Professor Vicent was the Chairman of the Materials Science Commission (Spanish National Science Foundation) and National Coordinator of the Materials Science Program (Spanish CICYT, Science & Technology Commission) 1993 – 1995. Prof. Vicent has been the advisor of more than 20 masters and Ph. D. graduate students. Prof. Vicent publications cover very different topics for example, a diversity of materials as single crystal layered compounds and metallic glasses, many different effects as superconducting vortex lattice dynamics, magnetic vortex dynamics, magneto-optical effects, superconducting critical current effects, and finally several low dimensional structures as high Tc superconducting oxide superlattices and metallic superlattices and so on.

Research lines

Prof. Vicent have worked on many research fields, mainly on Superconductivity and Magnetism, for instance low dimensional superconductivity, superlattices, magnetic metallic glasses, fabrication of magnetic and superconducting nanostructures, high temperature superconductivity, nanomagnetism, superconducting vortex physics, and hybrid magnetic/superconducting nanostructures.

Relevant publications

- "A Superconducting Reversible Rectifier that Controls the Motion of Magnetic Flux Quanta" J. E. Villegas, *et col.* *Science* **302**, 1188-1191 (2003)
- "Artificially Induced Reconfiguration of the Vortex Lattice by Arrays of Magnetic Dots" José I. Martín, *et col.* *Phys. Rev. Lett.* **83**, 1022, 1-4 (1999)
- "Ordered Magnetic Nanostructures: Fabrication and Properties" José I. Martín, *et col.* *Journal of Magnetism and Magnetic Materials* **256** 449-501 (2003)

Electrical conductivity of single molecules

Dr. Teresa González

Researcher

Ph.D. Universidad de Santiago de Compostela, Spain

Previous Position: University of Basel. Switzerland

Teresa González graduated in Physics in 1996 at the University of Santiago de Compostela (Spain). She got her Ph. D. in 2003 at the same university, with a study on melt-textured high-Tc superconductors, which was awarded with the Premio Extraordinario de Doctorado. From 2004 to 2008 Dr. González was Research Assistant at Basel University (Switzerland) with Professor Christian Schönenberger. There, she worked on the electrical properties of single molecules in a MCBJ setup. She joined IMDEA-Nanociencia as a Ramón y Cajal research fellow in 2008.

Research lines

Molecular electronics: study of the electrical properties of single molecules using a scanning tunnelling microscope. She investigates different techniques to contact an individual molecule, and studies its properties under different conditions, at low and room temperatures. Currently her research is focused on different studies about compounds such as alkanes, oligo(phenyleneethynylenes), fluorenes, porphyrines and phthalocyanines; and different chemical binding groups such as thiols, amines or C_{60}.

Relevant publications

- "Molecular junctions based on aromatic coupling" M. T. González, *et col.* *Nature Nanotechnology* **3**, 569-574 (2008)
- "Electrical conductance of molecular junctions by a robust statistical analysis" M. T. González, *et col.* *Nano Lett.* 2006, **6**, 2238 -2242
- "Enhancement of Jc under magnetic field by Zn doping in melt-textured Y-Ba-Cu-O superconductors" M. T. González, *et col.* *Supercond. Sci. Technol.* **15** 1372-1376 (2002)

Dr. Edmund Leary

Postdoc

University of Liverpool, UK

Siya Sherif

Ph.D. student

Fabrication and properties of nanostructured superconductors

Dr. David Pérez de Lara

Researcher

Ph.D.: Istituto di Cibernetica del CNR, Italy / Instituto Nacional de Física Nuclear (INFN), Italy

Previous Position: Universidad Complutense de Madrid, Spain

Graduated in Theoretical Physics at UAM (1994), David Pérez de Lara got a PhD from UAM-IC-CNR in 2003. he has had positions at ESA/ESTEC (The Netherlands 2 years), Istituto di Cibernetica of the National Italian Research Council (IC-CNR) , Italian Istituto Nazionale di Fisica Nucleare (INFN) (3 years), 'Decoherence and Entanglement in Quantum Complex Systems (DEQUACS-INFM 1 year), Fondo per gli Investimenti della Ricerca di Base (FIRB) of the Italian Ministry (MUR 3 years) and Universidad Complutense de Madrid (3 years). He had joined IMDEA Nanociencia in 2010.

Research lines

The main research activity is focused on the nanofabrication, experiments at low temperatures and modelization of superconducting devices with magnetic nanoarrays. Vortex dynamics and ratchet effects in superconductors are some relevant topics under investigation. This investigation is related to the development of superconducting-magnetic hybrid electronic devices based on a controlled and directional vortex motion.

Relevant publications

- "Rocking ratchet induced by pure magnetic potentials with broken reflection symmetry" D. Perez de Lara, *et col.* *Phys. Rev.* B **80**, 224510, 1-8
- "Static and dynamic properties of annular Josephson junctions with injected current" D. Perez de Lara, *et col.* *Phys. Rev.* B **73**, 214530, 1-6 (2006)
- "Recent developments in Superconducting Tunnel Junctions for Ultraviolet, Optical & Near Infrared" A. Peacock, *et col.* *Astronomy. Astrophys. Suppl. Ser.* **127**, 497-504 (1998)

Electrical transport in nanosytems

Prof. Nicolás Agraït

Associated Senior Scientist
Ph.D:UNED, Spain
Double Affiliation: Universidad Autónoma de Madrid. Spain

Nicolás Agraït got a Ph. D. in Physics from the UNED. He is Full Professor since 2007 at the Condensed Matter Physics Department of the UAM and Senior Associated Researcher at IMDEA-nanoscience. He is well-known for his pioneering work in quantum transport and forces in atomic-sized contacts and atomic chains, and has over 50 publications in peer-reviewed journals summing over 3,500 citations. Prof Agraït and collaborators have developed several novel local-probe systems for these measurements. They have very recently applied these techniques to single molecules successfully measuring transport and vibrational spectroscopy.

Research lines

- Transport through single molecules. Systematic study of transport properties at the single molecule level using STM.
- Atomically-thin crystals. Study of local mechanical and electronic properties of graphene and dichalcogenide crystals, using STM and AFM.
- Single molecule magnets. Study of the influence of substrate, including graphene and semiconducting atomically-thin crystals, on their magnetic properties using STM at low temperature.

Relevant publications

- "Study of electron-phonon interactions in a single molecule covalently connected to two electrodes" Hihath J. et col. *Nano Lett.* 2008, **8**, 1673-1678
- "Quantum properties of atomic-sized conductors" N. Agrait et col. *Phys. Reps.* **377**, 81-380 (2003)
- "Formation and manipulation of a metallic wire of single gold atoms"A.I. Yanson et col. *Nature* **395,** 783-785 (1998)

Physical properties of Nanostructures

Prof. Miguel Ángel G. García-Tuñón

Associated Scientist
Ph.D: University Complutense de Madrid, Spain
Double Affiliation: Instituto de Ceramica y Vidrio, CSIC, Spain

Dr. Garcia is an experimental physicist. His research deals with the magnetic and optical properties of nanostructures and the role of surface and proximity-effects in these systems. The work on optical properties is focused on surface plasmons of gold nanostructures. A key issue is the surface effects of gold-nanoparticles, studding the effect of surface capping, fabrication of complex nanostructures and the use of gold nanorods for biomedical and information applications. This research line includes also surface plasmons in Au films as probe to investigate growing films and surface effects.The work on magnetic nanoparticles has been mainly devoted to the modification of the physical properties at the nanoscale as well as their biomedical applications. Dr. Garcia is also interested in coupling and proximity effects in complex nanostructures, particularly correlation between optic, magnetic and transport properties.

Relevant publications

- "Surface plasmons in metallic nanoparticles: fundamentals and applications", M. A. Garcia. *J. Phys D: Appl. Phys* **44** (2011) 283001
- "Synthetic Tuning of the Catalytic Properties of Au-Fe_3O_4 Nanoparticles" Y. Lee *et al.* *Angew. Chem. Int. Ed.* 2010 **49,** 1271-1274
- "Sources of experimental errors in the observation of nanoscale magnetism" M. A. Garcia *et al.* *J. Appl. Phys.* **105** (2009) 013925 (7 pp)

programme 6
nanoacoustics and nanophotonics/nanooptics

The programme deals with Nanoacoustics and Nanophotonics, which have to do with phenomena in which either the (acoustic or optical) radiation *or* the matter are confined at sub-micrometer dimensions. In nanoacoustics, phase-sensitive acoustic microscopy, imaging, and non-destructive testing are developed, while the field of nanophotonics is both a Nobel Prize-winning science and a multibillion-dollar industry, underpinning applications such as telecommunications, data storage, and materials processing. Nanostructures and nanostructured materials exhibit fascinating optical response, and nanoscale-optics has already shown many surprises, such as extraordinary optical transmission, superlensing, giant field enhancement, optical trapping, and imaging with resolution far beyond the diffraction limit.

We also explore semiconductor materials as advantageous candidates to be the physical basis of storage and manipulation of quantum information. The growth and characterisation of semiconductor nanostructures, and photonic devices, such as LEDs, Lasers, pillars and photonic crystal cavities is also relevant for activities in Programme 1). The scientists in this Programme have developed optical microscopy in the near and far field, optical spectroscopy with coherent and nonlinear techniques, Raman and FTIR spectroscopy and spectroscopic SNOM.

Nanooptics and nanoacoustics

Prof. Reinhold Wannemacher

Senior Researcher

Ph.D: University of Darmstadt, Germany

Previous Position: University of Leipzig, Germany

Reinhold Wannemacher received his doctoral degree from Technische Universität Darmstadt and his "Habilitation" from Johann Wolfgang Goethe-Universität, Frankfurt, Germany. His scientific work in the areas of Optics and Acoustics was partly performed at The University of Georgia, IBM Almaden Research Laboratory, and Rijksuniversiteit Leiden. He has been a Guest Professor for Nano-Optics at Technische Universität Chemnitz, as well as a member of the Faculty of Physics and Geosciences of the University of Leipzig. He is the author of about 70 scientific articles.

Research lines

Nano-Optics. Optical microscopy in the near and far field. Optical spectroscopy, including coherent and nonlinear techniques, such as pump-probe, optical coherent transients, spectral hole-burning, optical-magnetic double resonance, up-conversion. Raman and FTIR spectroscopy. Mie scattering. Phase-sensitive acoustic microscopy, imaging, and non-destructive testing.

Relevant publications

- "Stimulated Resonance Raman Scattering and Laser Oscillation in Highly Emissive Distyrylbenzene-Based Molecular Crystals" S. Varghese, *et col*. *Adv. Mat.* **24,** 6473-6478 (2012)
- "Plasmon-Supported Transmission of Light through Nanometric Holes in Conductive Screens" R. Wannemacher *Opt. Commun*. **195**, 107-118 (2001)
- "Failure of Local Mie Theory: Optical Properties of Colloidal Aggregates" Pack, M., *et col. Opt. Commun*. **194,** 277-287 (2001)

Optical properties of semiconducting nanostructures

Dr. Daniel Granados

Researcher

Ph.D.: Universidad Autónoma de Madrid. Spain.

Previous Position: Toshiba Research Europe Ltd. (TREL), Cambridge, UK

Daniel Granados worked for a Ph.D. at the group of molecular beam epitaxy of IMM-CNM-CSIC, on the growth and characterisation of III-V semiconductor Nanostructures. For six months he was an invited researcher at theNano-Optics group of the Heriott-Watt University in Edinburgh (Scotland), working on single Quantum dot optical characterisation. After this, Dr. Granados joined the Quantum Information Group of Toshiba Research Europe Ltd in Cambridge (UK), as a research scientist; working on photon confinement and cavity quantum electrodynamics. He joined IMDEA-Nanoscience in September 2009.

Research lines

My research interests are the growth and characterisation of semiconductor nanostructures, and the development and characterisation of photonic devices, such as LEDs, LASERS, pillars and photonic crystal cavities, for optoelectronics, quantum optics and quantum information applications.

Relevant publications

- "Oscillatory persistent currents in self-assembled quantum rings" Kleemans, NAJM, *et al*. *Phys. Rev. Lett.* **99**, 146808, 1-3 (2007)
- "Manipulating exciton fine structure in quantum dots with a lateral electric field" Gerardot, BD, *et al. Appl. Phys. Lett.* **90**, 041101, 1-3 (2007)
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3.1. publications and contribution to books

3.1.1. Publications

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80. **A Straightforward Electroactive π-Extended Tetrathiafulvalene (exTTF) Building Block** Agustín Molina-Ontoria, Raúl García Andreas Gouloumis, Francesco Giacalone, M. Rosario Torres, Nazario Martín *Eur. J. Org. Chem.,* 2012: 3581–3586.doi:10.1002/ejoc.201200115

81. **π-Conjugation** B. Milián-Medina, J. Gierschner *WIREs Comput. Mol. Sci.* (2012) **2**: 513–524. doi: 10.1002/wcms.95

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83. **Direct observation of magnetization reversal and low field magnetoresistance of epitaxial La0.7Sr0.3Mn03/SrTi03 (001) thin films at room temperature** Fadil, D.; Wu, S.; Perna, P.; Renault, B.; Saib, M.; Lebargy, S.; Gasnier, J.; Guillet, B.; Routoure, J. -M.; Flament, S.; Mechin, L. *J. Appl. Phys.* **112**, 013906 (9 pp) (2012) doi: 10.1063/1.4730966

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85. **A paradigmatic change: linking fullerenes to electron acceptors** Lai Feng, Marc Rudolf, Silke Wolfrum, Anna Troeger, Zdenek Slanina, Takeshi Akasaka, Shigeru Nagase, Nazario Martín, Tayebeh Ameri, Christoph J Brabec, Dirk M Guldi *J. Am. Chem.Soc.* **134**, 12190-7. doi:10.1021/ja3039695

86. **Repeat-protein templates for assembly and patterning of nanostructured materials** Mikuszeit, N.; Luo, F.; Gomez-Santos, G.; Camarero, J.; Miranda, R. *Phys. Rev. B* **86,** 054423 doi:10.1103/PhysRevB.86.054423

87. **Substrate polarization effects in two-dimensional magnetic arrays** Mikuszeit, N.; Luo, F.; Gomez-Santos, G.; Camarero, J.; Miranda, R. *Phys. Rev. B* **86**, 054423 (2012) (5 pp). doi: 10.1103/PhysRevB.86.054423

88. **Postfunctionalization of Helical Polyisocyanopeptides with Phthalocyanine Chromophores by Click Chemistry** Lopez-Duarte, Ismael; Victoria Martinez-Diaz, M.; Schwartz, Erik; Koepf, Matthieu; Kouwer, Paul H. J.; Rowan, Alan E.; Nolte, Roeland J. M.; Torres, Tomas *ChemPlusChem* 2012 **77**, 700-706. doi: 10.1002/cplu.201200087

89. **Mechanical properties of freely suspended atomically thin dielectric layers of mica** Castellanos-Gomez, Andres; Poot, Menno; Amor-Amoros, Albert; Steele, Gary A.; van der Zant, Herre S. J.; Agrait, Nicolas; Rubio-Bollinger, Gabino *Nano Research* 2012 **5,**550-557. doi:10.1007/s12274-012-0240-3

90. **Simultaneous surface plasmon resonance and x-ray absorption spectroscopy** Serrano, A.; Rodriguez de la Fuente, O.; Collado, V.; Rubio-Zuazo, J.; Monton, C.; Castro, G. R.; Garcia, M. A. *Rev. Sci. Instrum.* **83**, 083101 (7 pp) (2012).http://dx.doi.org/10.1063/1.4739773

91. **Interaction of viral ATPases with nucleotides measured with a microcantilever** Mertens, Johann; Dauden, Maria I.; Carrascosa, Jose L.; Tamayo, Javier *Sens Actuators B Chem* 2012 **171**, 263-270. doi:10.1016/j.snb.2012.03.062

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93. **Accurate determination of the specific absorption rate in superparamagnetic nanoparticles under non-adiabatic conditions** F. J. Teran, C. Casado, N. Mikuszeit1, G. Salas, A. Bollero1, M. P. Morales, J. Camarero, and R. Miranda *Appl. Phys. Lett.* **101**,062413 (4 pp) (2012). doi: 10.1063/1.4742918

94. **Entropy Involved in Fidelity of DNA Replication** J. Ricardo Arias-Gonzalez (2012) *PLoS ONE* **7**(8) e42272. doi: 10.1371/journal.pone.0042272

95. **Commensurate solid-solid phase transitions in self-assembled monolayers of alkylthiolates lying on metal surfaces.** Wang Y,Solano-Canchaya JG, Alcamí M, Busnengo HF, Martín F. *J. Am. Chem. Soc* .**134**, 13224-13227. doi: 10.1021/ja305842t.

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99. **Reversible Fluorescence Photoswitching in DNA** Darren A. Smith, Philipp Holliger, and Cristina Flors *J. Phys. Chem. B* 2012,**116**, pp 10290–10293. doi: 10.1021/jp3056834

100. **Donor-p-Acceptors Containing the 10-(1,3-Dithiol-2-ylidene)anthracene Unit for Dye-Sensitized Solar Cells** Pierre-Antoine Bouit, Magdalena Marszalek, Robin Humphry-Baker, Rafael Viruela, Enrique Ortí, Shaik M. Zakeeruddin, Michael Grätzel, Juan Luis Delgado, and Nazario Martín *Chem. Eur. J.* 2012, **18**, 11621– 11629. doi: 10.1002/chem.201201022

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103. **Effect of photodiode angular response on surface plasmon resonance measurements in the Kretschmann-Raether configuration** Galvez, F.; Monton, C.; Serrano, A.; Valmianski, I.; de la Venta, J.; Schuller, Ivan K.; Garcia, M. A. *Rev.*

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104. **Characterization of hybrid cobalt-porous silicon systems: protective effect of the Matrix in the metal oxidation** Munoz-Noval, Alvaro; Gallach, Dario; Angel Garcia, Miguel; Ferro-Llanos, Vicente; Herrero, Pilar; Fukami, Kazuhiro; Ogata, Yukio H.; Torres-Costa, Vicente; Martin-Palma, Raul J.; Ciment-Font, Aurelio; Manso-Silvan, Miguel *Nanoscale Research Letters* 2012 **7** 495. doi: 10.1186/1556-276X-7-495

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106. **Supramolecular Interaction of Single-Walled Carbon Nanotubes with a Functional TTF-Based Mediator Probed by Field-Effect Transistor Devices** Wurl, Annette; Goossen, Sebastian; Canevet, David; Salle, Marc; Perez, Emilio M.; Martin, Nazario; Klinke, Christian *J. Phys. Chem. C* 2012 **116**, 20062-20066. doi: 10.1021/jp304970j

107. **Step-by-step self-assembled hybrids that feature control over energy and charge transfer** Grimm, B Schornbaum, J ; Jasch, H ; Trukhina, O ; Wessendorf, F ; Hirsch, A ; Torres, T ; Guldi, DM *Proc. Nat. Acad. Soc. USA* **109** 15565-15571 doi: 10.1073/pnas.1113753109

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110. **Superconducting Vortex Lattice Configurations on Periodic Potentials: Simulation and Experiment** Rodriguez-Pascual, M.; Gomez, A.; Mayo-Garcia, R.; Perez de Lara, D.; Gonzalez, E. M.; Rubio-Montero, A. J.; Vicent, J. L. *J. Superconductivity and Novel Magnetism* **25**, 2127-2130. doi: 10.1007/s10948-012-1636-8

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114. **Mechanical Properties of beta-Catenin Revealed by Single-Molecule Experiments** Valbuena, Alejandro; Manuel Vera, Andres; Oroz, Javier; Menendez, Margarita; Carrion-Vazquez, Mariano *Biophysical Journal* 103 2012, 1744-1752. dio: 10.1016/j.bpj.2012.07.051

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116. **Unique Piezochromic Fluorescence Behavior of Dicyanodistyrylbenzene Based Donor–Acceptor–Donor Triad: Mechanically Controlled Photoinduced Electron Transfer (eT) in Molecular Assemblies** M. S. Kwon, J. Gierschner, S.-J. Yoon, S. Y. Park, *Adv. Mater.* **24** (2012) 5487–5492. doi: 10.1002/adma.201202409

117. **Towards artificial photosynthesis: Supramolecular, donor-acceptor, porphyrin-and phthalocyanine/carbon nanostructure ensembles** Bottari, Giovanni; Trukhina, Olga; Ince, Mine; Torres, Tomas *Coordination Chemistry Reviews* **256 (**2012) 2453-2477 doi: 10.1016/j.ccr.2012.03.011

118. **Highly reproducible low temperature scanning tunneling microscopy and spectroscopy with in situ prepared tips** Castellanos-Gomez, Andres; Rubio-Bollinger, Gabino; Garnica, Manuela; Barja, Sara; Vazquez de Parga, Amadeo L.; Miranda, Rodolfo; Agrait, Nicolas *Ultramicroscopy* **122**,1-5 (2012) doi: 10.1016/j.ultramic.2012.07.021

119. **Investigation of the interference effect in the case of low energy electron emission from O-2 in collisions with fast bare C-ions** Nandi, Saikat; Agnihotri, A. N.; Tachino, C. A.; Rivarola, R. D.; Martin, F.; Tribedi, Lokesh C**.** *J. Phys. B: At. Mol. Opt. Phys.* **45** 215207 (6 pp) doi: 10.1088/0953-4075/45/21/215207

120. **Ultrafast Photoinduced Processes in Subphthalocyanine Electron Donor-Acceptor Conjugates Linked by a Single B-N Bond** Romero-Nieto, Carlos; Guilleme, Julia; Fernandez-Ariza, Javier; Salome Rodriguez-Morgade, M.; Gonzalez-Rodriguez, David; Torres, Tomas; Guldi, Dirk M. *Organic Letters* **14** (2012), 5656-5659**.** doi: 10.1021/ol302632u

121. **Pump Probe Scheme To Study the Autoionization Decay of Optically-Forbidden H-2 Doubly Excited States** Riviere, P.; Silva, R. E. F.; Martin, F. *J. Phys. Chem. A*, 2012, **116**, pp 11304-11310**.** doi: 10.1021/jp3053136i

122. **Ordered rippling of polymer surfaces by nanolithography: influence of scan pattern and boundary effects** Napolitano, Simone; D'Acunto, Mario; Baschieri, Paolo; Gnecco, Enrico; Pingue, Pasqualantonio *Nanotechnology* **23** (2012) 475301 (6pp). doi:10.1088/0957-4484/23/47/475301

123. **Superconducting vortex dynamics on arrays with bicrystal-like structures: matching and rectifier effects** Gomez, A.; Gonzalez, E. M.; Vicent, J. L. *Supercond. Sci. Technol.* **25** 124006 (6pp). doi: 2048/25/12/124006

124. **Tuning the Electronic Properties of Nonplanar exTTF-Based Push-Pull Chromophores by Aryl Substitution G**arcia, Raul; Angeles Herranz, Ma; Rosario Torres, Ma; Bouit, Pierre-Antoine; Luis Delgado, Juan; Calbo, Joaquin; Viruela, Pedro M.; Orti, Enrique; Martin, Nazario *J. Org. Chem.* 2012, **77**, 10707–10717. doi: 10.1021/jo302047m

125. **Preparation of glycopolymer-coated magnetite nanoparticles for hyperthermia treatment** Alexandra Muñoz-Bonilla Gema Marcelo Cintia Casado Francisco J. Teran Marta Fernández-García *J. Polymer Sci. Part A: Polymer Chemistry* 2012, **50**, 5087–5096. doi: 10.1002/pola.26367

126. **Stimulated Resonance Raman Scattering and Lasing Oscillation in Highly Emissive Distyrylbenzene Based Molecular Crystals** S. Varghese, S.-J. Yoon, E. M. Calzado, S. Casado, P. G. Boj, M. A. Díaz-García, R. Resel, R. Fischer, B. Milián-Medina, R. Wannemacher, S. Y. Park, J. Gierschner *Adv. Mater.* **24** (2012) 6473-6478. doi: 10.1002/adma.201202525

127. **The structure of native influenza virion ribonucleoproteins** Arranz R, Coloma R, Chichón FJ, Conesa JJ, Carrascosa JL, Valpuesta JM, Ortín J, Martín-Benito J. *Science* 2012, **338** (6114):1634-7. doi: 10.1126/science.1228172

3.1.2. Contributions to books

1. **Synthesis of Inorganic Nanoparticles**. Gorka Salas, Rocío Costo and María del Puerto Morales. In Frontiers of Nanoscience 2012, Vol. 4: Nanobiotechnology: Inorganic Nanoparticles *vs* Organic Nanoparticles, Chapter 2, pp. 35-79. Elsevier, Amsterdam

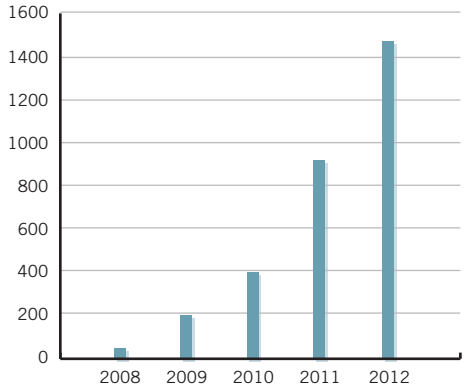
2. **Phthalocyanine-porphyrin heteroarrays: A perfect marriage between two unique macrocycles** G. Bottari, G. de la Torre, D. M. Guldi, T. Torres In Multiporphyrin Arrays: Fundamentals and Applications, D. Kim, Ed.; Pan Stanford Publishing Pte. Ltd.: Singapore, 2012, Chapter 4, pp. 149-216.

3. **Supramolecular Phthalocyanine-based Systems** C. G. Claessens, M.V. Martínez-Díaz, T. Torres in Supramolecular Chemistry: From Molecules to Nanomaterials, Eds. P. A. Gale, J. W. Steed, John Wiley & Sons, Ltd, Chichester, 2012, 1075-1100

contributions to books

impact of the publications

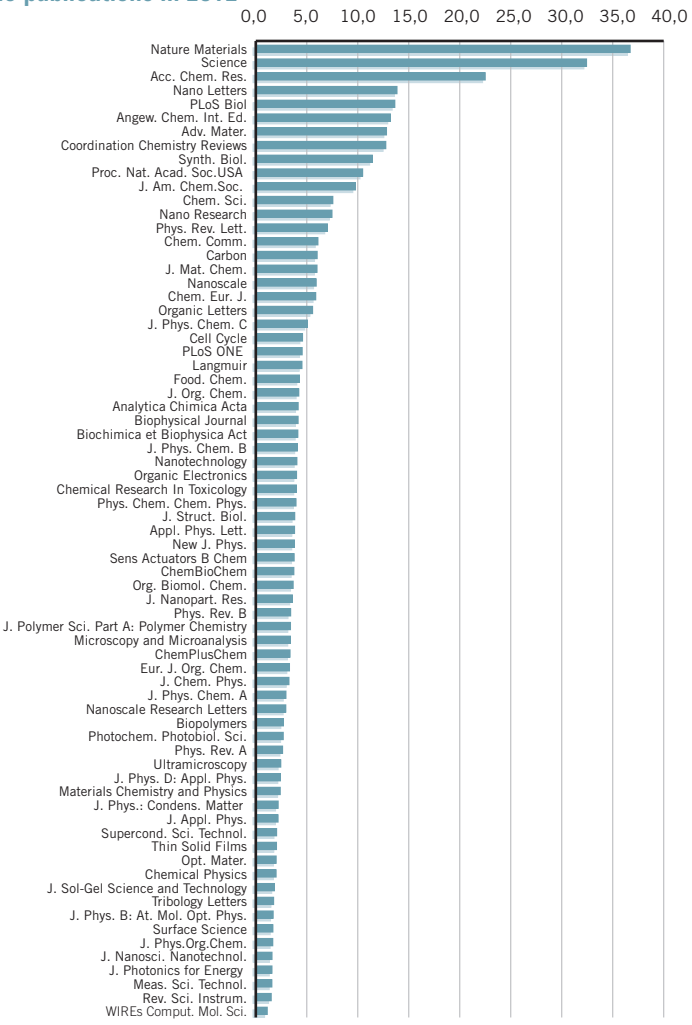
Citations in each year



- **Sum of the times cited:** 3338
- **Sum of Times Cited without self-citations:** 2818
- **Average citation per item:** 10,07
- **h index:** 28

Periodically rippled graphene: growth and spatially resolved electronic structure
Vazquez de Parga A. L.; Calleja F.; Borca B.; Guinea F. and Miranda R., *Phys. Rev. Lett.* TC: 233

Impact factor of the publications in 2012



Average impact factor: 5,67

3.2. International congresses

3.2.1. Regular contributions and invited lectures

22-23/01/2012

ELFOS Workshop, Copenhagen, Denmark

Oral contribution

"Scanning tunneling spectroscopy of POM molecules at low temperatures" N. Agrait, Siya Sherif, Edmund Leary

02-04/02/2012

International Symposium on Macrocyclic and Supramolecular Chemistry, ISMCS-7 Dunedin, New Zealand

Invited lecture

"Synthesis of Subphthalocyanine-Complexes" TomásTorres

02-04/02/2012

3rd European Symposium on Computing pi-Conjugated Compounds (CpiC3), Mons, Belgium

Oral contribution

"Computational Design of low singlet-triplet gap all-organic molecules for OLED application" B. Milián-Medina

Posters

"Photodegradation in conjugated polymers" A. Aguirre, J. Gierschner, B. Milián-Medina

"Stimulated resonance Raman scattering and laser oscillation in the monolithic molecular single crystal" S. Varghese, J. Gierschner, B. Milián-Medina

10-14/02/2012

9th Spanish-Italian Symposium on Organic Chemistry (SISOC-IX) Tenerife, Spain

Invited lecture

"Carbon-Based Materials for the Preparation of Photovoltaic Devices" Juan L. Delgado

22-23/02/2012

Conference on Supramolecular Chemistry, Lanzarote, Spain

Invited lecture

"Charge-Transfer Effects on the Self-Assembly and Polymerization of Organic Acceptors on Metal Surfaces" C. Urban, J. Rodríguez-Fernández, M. A. Herranz, Y. Wang, M. Alcamí, F. Martín, N. Martín, J. M. Gallego, R. Miranda and R. Otero,

21.02-01.03/2012

Nanospain 2012, Santander, Spain

Oral contribution

"Electrical and mechanical properties of graphene and graphene-like layers" N. Agraït, A. Castellanos-Gómez, G. Rubio-Bollinger

27.02-02/03/2012

APS March Meeting 2012, Boston, Massachusetts, USA

Oral contribution

"Reliable anchoring groups for single-molecule junctions" M. Teresa González, Edmund Leary, Charalambos Evangeli, Carlos Arroyo, Gabino Rubio-Bollinger, Nicolás Agraït

08-09/03/2012

2012 Biennial Meeting of Chemical Biology, Santiago de Compostela, Spain

Oral contribution

"Self-assembly of repeat proteins: towards the generation of biomaterials" A. Lopez-Cortajarena

Poster

"Peptide functionalization of magnetic nanoparticles for cancer detection and/or hyperthermia treatment" Couleaud, P.; Salas, G.; Calera, M.; Villanueva, A; Morales, M.P.; Lopez-Cortajarena, A.

08-09/03/2012

International Symposium on Electronic/Optic Functional Molecules, Shanghai, China.

Invited lecture

"Phthalocyanines for Molecular Photovoltaics" Tomás Torres

03/03/2012

71- International Workshop on Surface Chemistry Beijing, China

Invited talk

"Charge Transfer at Surfaces: An Essential Step for Molecular Conformation, Self-Organization and Selective Catalysis" Rodolfo Miranda

25-26/03/2012

243rd ACS National Meeting, San Diego, USA

Invited lecture

Phthalocyanines for Molecular Photovoltaics" Tomás Torres

Oral contribution

"One size fits ball: macrocyclic hosts for fullerenes with micromolar affinity" E. Pérez

27/03/2012

72- Asian Conference on "Advances on graphene processing and properties" Beijing, China

Invited talk

"Adding Molecular Functionalities to Epitaxial Graphene" Rodolfo Miranda

01-04/04/2012

Focus on Microscopy, Singapore

Oral contribution

"Eversible Fluorescence Photoswitching In Dna: Applications In Advanced Fluorescence Microscopy" Cristina Flors

08-10/04/2012

International Conference of Young Chemists (ICYC), Amman, Jordan

Oral contribution

"New Carbon-Based Materials for the Preparation of Photovoltaic Devices" Juan L. Delgado

09-13/04/2012

2012 MRS Spring Meeting, San Francisco, USA

Oral contributions

"Perpendicular Exchange Spring FM/FM System Based on [Pt/Co]/NiFe with Isothermally-induced and Tunable Exchange Bias" Alberto Bollero, V. Baltz, L. D. Buda-Prejbeanu, B. Rodmacq, M. A. Niño, J. Camarero, R. Miranda, B. Dieny

"Plasmon-exciton interactions on single thermo-responsive platforms demonstrated by optical tweezers" B. H. Juárez

"Simultaneous study of magnetization reversal and magneto-resistive properties in spin-valve" P. Perna, C. Rodrigo, M. Muñoz, J.L. Prieto, A. Bollero, J. L. F. Cuñado, D. Maccariello, M. Romera, J. Akerman, E. Jimenez, N.i Mikuszeit, J.Camarero, R. Miranda

10/04/2012

Workshop "Recent advances in Scanning Tunneling Microscopies" Zaragoza, Spain

Invited lecture

"Nanostructured graphene: a two dimensional playground for surface science studies "A.L. Vázquez de Parga

16-20/04/2012

3rd European Workshop on Self Organized Nanomagnets - 2012, Guadarrama, Spain

Invited lecture

"Electron aceptor molecules on graphene/Ru (0001)" A.L. Vázquez de Parga.

Oral contributions

"Large-Scale Synthesis of Single-Crystalline Iron Oxide Magnetic Nanorings and Nanotubes" Feng Luo

"Surface electron microscopy of ultrathin magnetite films" M. Monti, A. Quesada, L. Vergara, A.T. N'Diaye, B. Santos, A. Mascaraque, O. Rodríguez de la Fuente, M.A. Niño, T.O. Mentes, A. Locatelli, K.F. McCarty, A.K. Schmid, J.F. Marco, J. de la Figuera

"Mechanism involved in magnetically-induced thermal response of iron oxide nanoparticles under dynamical conditions" C.Casado, H.Takacs, G.Salas, M.P.Morales, F.J.Pedrosa, A.Bollero, J.Camarero, F.J.Terán, and R.Miranda.

"Simultaneous Study Of Magnetization Reversal And Magnetoresistive Properties In Spin-Valve Structures" C. Rodrigo, P. Perna, M. Muñoz, J. L. Prieto, A. Bollero, J. L. F. Cuñado, M.Romera, J. Akermann, E. Jimenez, N. Mikuszeit, V. Cros, J. Camarero and R. Miranda

18/04/20121

12th Eurasia Conference on Chemical Sciences Corfu, Greece

Invited lecture

"Photoactive Phthalocyanine- and Subphthalocyanine- Containing Ensembles" Tomás Torres

25-27/04/2012

3rd European Nanomanipulation Workshop, Madrid, Spain

Oral contributions

"Ripple patterns induced by nano-abrasive wear: Modeling and AFM experiments"Enrico Gnecco

"Individual response of organic and synthetic nanoparticles to external stimuli revealed by optical manipulation" J.R. Arias-Gonzalez.

02-05/05/2012

2012 IEEE International Symposium on Biomedical Imaging: From Nano to Macro. Barcelona, Spain

Invited lecture

"X-ray Tomography of Biological Material: Bridging a resolution gap". José L. Carrascosa.

07-11/05/2012

NaNaX5.Nanoscience with Nanocrystals Malaga, Spain

Oral contributions

"Thermo-responsive Platforms with Quantum Dots and Au Nanoparticles Trapped by Optical Tweezers; Synthesis and Optical Studies" Silvia Hormeño, Neus G. Bastús, Andrea Pietsch, Horst Weller, Ricardo Arias González, and Beatriz H. Juárez

Posters

"Metal Oxide Carbon Nanotube Composites for Electronic Devices" Alina Chanaewa, Beatriz H. Juárez, Christian Klinke, and Horst Weller

"Surface study of CdSe nanocrystals attached to sp2 carbon surfaces by XPS and solid NMR Fabiola Iacono, Leonor de la Cueva,Cristina Palencia, Jonathan Rodriguez-Fernández, J. M.Gallego, Roberto Otero, and Beatriz H. Juarez.

"Electrochemical studies on semiconductor nanocrystals" L. de la Cueva, C. Alonso and B. H. Juárez

"Surface study of CdSe nanocrystals attached to sp2 carbon surfaces by XPS and solid NMR" Fabiola Iacono, Leonor de la Cueva, Cristina Palencia, Jonathan Rodriguez-Fernández, J. M.Gallego, Roberto Otero, and Beatriz H. Juarez.

10/05/2012

221th Meeting of the Electrochemical Society, Seattle, WA, USA

Invited lecture

"Synthesis of Subphthalocyanine p-complexes" Tomas Torres

11/05/2012

Yale Chemical Biology symposium. New Haven, CT, U.S.A.

Poster

"Peptide functionalization of magnetic nanoparticles for cancer detection and/or hyperthermia treatment." Couleaud, P.; Salas, G.; Latorre, A.; Courty, J.; Somoza, A.; Morales, M.P.; López-Cortajarena, A.

12-14/05/2012

European Materias Research Society Symposium, Strasbourg, France

Oral contribution

"Picosecond charge photogeneration and transport" Juan Cabanillas

17-20/05/2012

3rd Molecular Electronic Assemblies Workshop, Adelsdorf, Germany

Oral contribution

"Understanding electron transport though one and two C60 molecules bridging gold electrodes - Theory and experiment" Charalambos Evangeli, E. Leary, M.T. González and Nicolás Agraït

18/05/2012

2nd Spanish Workshop on Nano Bio Science, Madrid, Spain.

Oral contribution

"Mechanical stability of low-humidity single DNA molecules" S. Hormeño, B. Ibarra, J.M. Valpuesta, J.L. Carrascosa, F. Moreno-Herrero and J.R. Arias-González.

22-25/05/2012

CECAM Workshop on Quantum Transport in Molecular Nanostructures, Trinity College Dublin, Ireland

Oral contribution

"Unambiguous One-molecule Transport under Ambient Conditions", N. Agraït.

01-06/06/2012

16th International Conference on Solid Films and Surfaces (ICSFS), Geneva, Italy.

Invited lecture

"Recent Developments in Nanotribology: Electron vs. Phonon Damping, Friction Anisotropy, and Controlled Manipulation" Enrico Gnecco.

03-07/06/2012

14th International Conference on Electroanalysis, ESEAC 2012 Portoroz, Slovenia.

Plenary Conference. Invited lecture

"Nanomaterials for Analytical Sensing Platforms" M. Encarnación Lorenzo

13-14/06/2012

4th ELFOS meeting, Gothenburg, Sweden

Oral contributions

"Deposition of POM single-molecule magnets on gold and graphite/graphene" Siya Sherif, Nicolas Agrait

"Electron transport through cruciforms" Edmund Leary, Nicolas Agrait

24-28/06/2012

XIX International Poxvirus, Asfarvirus And Iridovirus Conference. Salamanca, Spain.

Oral contribution

"Cartography of vaccinica virus infection by cryo-x-ray nano-tomography" Chichon, F.J. Rodríguez, M.J., Pereiro, E., Chiappi, M., Perdiguero, B., Guttmann, P., Werner, S., Rehbein, S., Schneider, G., Esteban, M. and Carrascosa, J.L.

24-29/06/2012

Gordon Research Conference, Bioinspired materials. Davidson Collage, Davidson, NC, U.S.A.

Poster

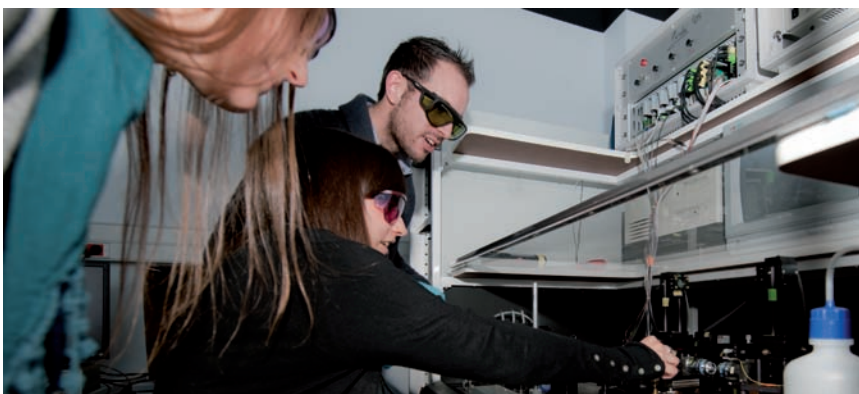
"Repeat-protein templates for assembly and patterning of nanostructured materials" Grove, T ; Parker, R ; Regan, L ; Cortajarena, A.L.

25-27/06/2012

International Conference of Organic Electronics, Tarragona, Spain

Oral contribution

"Organic position sensitive photodetectors based on wedge donor-acceptor layers with complementary thickness " Juan Cabanillas



01-06/07/2012

15th International Congress on Catalysis, Munich, Germany

Oral contribution

"Catalytic relevant oxygen species on silver: effects on the mesoscopic length scale and contribution of bulk oxygen diffusion to the surface" S. Gunther, M. A. Niño, T.O. Mentes, A. Locatelli, S. Bocklein, J. Wintterlin

02/07/2012

7th International Conference on Porphyrins and Phthalocyanines, Jeju, Korea

Invited lecture

"Subphthalocyanines as Efficient Fullerene Receptors" Tomas Torres

02-04/07/2012

6th International Meeting on Developments in Materials, Processes and Applications of Emerging Technologies (MPA TECH), Alvor, Portugal

Oral contribution

"Nanoliposomes used as a new strategy to enhance Photodynamic Therapy of cancer: in vitro and in vivo studies" P. Acedo, M. Camerin, G. Jori, A. Villanueva

02-06/07/2012

International Conference on Excitonic Processes in Condensed Matter, Nanostructured and Molecular Materials, EXCON 2012, Groningen (The Netherlands)

Oral contributions

"Tracing of Backward Energy Transfer from LH1 to LH2 in Photosynthetic Membranes Grown Under High and Low Irradiation" Larry Lüer, Vladimira Moulisová, Sarah Henry, Dario Polli, Tatas H. P. Brotosudarmo, Sajjad Hoseinkhani, Daniele Brida, Guglielmo Lanzani, Giulio Cerullo, and Richard J. Cogdell

"Field induced charge photogeneration and picosecond charge transport in conjugated polymers" Juan Cabanillas

"Stimulated Emission and Related Phenomena in The Single Crystals of Dicyano-distyrylbenzene Derivatives" S. Varghese, J. Gierschner, B. Milián-Medina

03-06/07/2012

5th International Conference on Molecular Materials (MOLMAT), Barcelona, Spain

Plenary Talk

"Electroactive Concave Receptors for Carbon Nanostructures" Nazario Martín

03-06/07/2012

XII Congress of the Spanish Biophysical Society, Barcelona, Spain

Oral contributions

"The elastic response of double-stranded RNA" E. Herrero-Galán, M.E. Fuentes-Pérez, J.M. Valpuesta, J.L. Carrascosa, F. Moreno-Herrero and J.R. Arias-González.

"DNA Unwinding Dynamics during DNA replication" B. Ibarra

"Using optical tweezers to study the DNA unwinding dynamics of a processive DNA polymerase" José A. Morin, Francisco Cao, José M. Valpuesta, José L. Carrascosa, Margarita Salas, Borja Ibarra.

06/07/2012

2nd symposium on "Carbon Nanoforms" National Institute of Advanced Industrial Science and Technology (AIST) Tsukuba, Japan

Plenary lecture

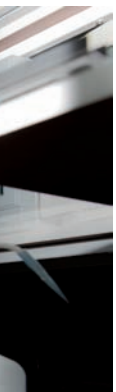
"Photoactive Phthalocyanine- and Subphthalo- cyanine-containing Carbon Nanostructures" T.Torres

06/07/2012

7th International Conference on Porphyrins and Phthalocyanines, Jeju, Korea

Invited lecture

"Phthalocyanines for Molecular Photovoltaics" Tomas Torres



08/07/2012

Ultrafast Phenomena 2012, Lausanne (CH)

Oral contribution

"Tracing of backward energy transfer from LH2 to LH1 in photosynthetic membranes grown under high and low irradiation." L. Lüer, V. Moulisová, S. Henry, D. Polli, T. H. P. Brotosudarmo, S. Hoseinkhani, D. Brida, G. Lanzani, G. Cerullo, and R. J. Cogdell

08-12/07/2012

IUVSTA WS-66: Friction under Controlled Environments, Avila, Spain.

Invited lecture

"Recent Developments in Nanotribology: Electron vs. Phonon Damping and Friction Anisotropy" Enrico Gnecco

08-13/07/2012

ICSM 2012 Atlanta, USA

Oral contribution

"New Carbon-Based Materials for the Preparation of Dye Sensitized Solar Cells" Juan L. Delgado and Nazario Martín

09-12/07/2012

2nd symposium on Carbon Nanoforms at National Institute of Advanced Industrial Science and Technology (AIST) Tsukuba, Japan

Invited lecture

"Photoactive Phthalocyanine- and Subphthalocyanine-containing Carbon Nanostructures" Tomas Torres

11-13/07/2012

24 Reunión Bienal de Química Orgánica, San Sebastián, Spain

Plenary Talk. Invited lecture

"Supramolecular Chemistry of Carbon Nanostructures: Concave-convex Interactions". Nazario Martín

15-20/07/2012

XIX International Nicolas Cabrera Summer School on fluorescent nanoparticles in bio-medicine, Julio 2012, Miraflores de la Sierra, Spain

Invited Talk

"Magnetic Nanoparticles for cancer treatment" F.J. Teran, C. Casado, N. Mikuszeit, G. Salas, M.P. Morales, A. Bollero, J. Camarero, A. Villanueva, M. Calero, P. Couleaud, A. Lopez-Cortajarena, A. Latorre, A. Somoza, and R. Miranda

Oral contribution

"Thermal studies of iron oxide nanoparticles under dynamical regime conditions for hyperthermia therapeutic approach" C.Casado, H.Takacs, G.Salas, M.P.Morales, N. Mikuszeit, A.Bollero, J.Camarero, F.J.Terán, and R.Miranda.

15-20/07/2012

Single Molecule Approaches to Biology. Gordon Research Conference. Vermont, USA.

Poster

"Unraveling the mechanochemistry of a replicative DNA polymerase-Morín, J.A., Cao, J.M: Lázaro, F.J, Valpuesta, J.M., Salas, M., Carrascosa, J.L., Ibarra, B.

23-27/07/2012

International Conference in Nanoscience+Technology 2012 (ICNT2012), Paris, France

Oral contributions

"Formation of a spatially extended intermolecular band for TCNQ molecules on graphene/Ru (0001) studied by means of scanning tunneling spectroscopy and DFT calculations"M. Garnica, D. Stradi, S. Barja, C. Díaz, M. Alcamí, A.L. Vázquez de Parga, N. Martín, F. Martín and R. Miranda

"Self-Assembly of Electron Acceptor TCNQ-Class Molecules on Tailored Graphene" F. Pendolino, F. Calleja, A.L. Vazquez de Parga, R. Miranda

"Electron localization in epitaxial graphene on Ru(0001)" D. Stradi, S. Barja, C. Díaz, M. Garnica, B. Borca, J.J. Hinarejos, D. Sanchez-Portal, M. Alcami, A. Arnau, A.L. Vázquez de Parga, F. Martín and R. Miranda

"Surface-Assisted Polymerization of Some Organic Acceptors of the TCNQ Family" Gallego, C Urban, Y Wang, J RodrÍguez-Fernández, L Terracciano, R García, M Alcamí, M A Herranz, N Martín, F Martí, R Otero and R Miranda

"The Interaction Between CdSe Nanoparticles and sp2 Carbon Surfaces Studied by Scanning Tunneling Microscopy and X-ray Photoelectron Spectroscopy"F Iacono, L de la Cueva, C Palencia, J Rodriguez-Fernandez, J M Gallego, R Miranda, B Juárez and R Otero

"Catalytic Role of Charge-Transfer in the Trans-Cis Isomerization of DCNQI on the Cu(100) Surface" J Rodríguez-Fernández, C Urban, Y Wang, R García, M A Herranz, M Alcamí, N Martín, J M Gallego, F Martín, R Otero and R Miranda

"New Strategies for the Fabrication of Macrocycle-Based Molecular Nanostructures on Solid Surfaces"Marta Trelka, David Ecija, Christian Urban, Jose Maria Gallego, Rodolfo Miranda and Roberto Otero

24-29/07/2012

International School of Solid State Physics, Erice, Sicily

Invited lecture

"Optical and Photophysical Processes in Organic Crystals" Johannes Gierschner

05-08/08/2012

26th Symposium of The Protein Society, San Diego, CA, USA

Poster

"Repeat-protein templates for assembly and patterning of nanostructured materials" Grove, T ; Parker, R ; Regan, L ; Cortajarena, A.L.

08-13/08/2012

(ICSM 2012). International Conference on Science and Technology of Syntheic Materials Atlanta, USA.

Oral contribution

"New Carbon-Based Materials for the Preparation of Dye Sensitized Solar Cells" Juan L. Delgado

12-18/08/2012

XXI International Materials Research Congress, Cancún (México)

Invited lecture

"Structural and Chemical Effects of Charge Transfer at Metal-Organic Interface" R. Otero

29-31/08/2012

2nd Swiss Single Molecule Localization Microscopy Symposium, EPFL, LaussaneSwitzerland

Invited lecture

"Sequence specificity and controllable fluorescence photoswitching in localization-based super-resolution microscopy of DNA" Cristina.Flors

29-30/08/2012

Eighteenth Users Workshops on X-ray Bio-imaging. Hsinchu, Taiwan.

Oral contribution

"Cellular Landscape of Viral Maturation by X-ray Cryo-nano Tomography" J.L.Carrascosa

02-07/09/2012

25th International Conference on Organometallic Chemistry, Lisboa, Portugal

Plenary Lecture

"Chiral Fullerenes by Metal Catalyzed Asymmetric Synthesis" Nazario Martín

03-05/09/2012

European Conference on Surface Science ECOSS-29, Edimburgh, UK

Oral contributions

"Structure determination of pseudomorphic and close packed Ni overlayers on W(110)" J. Ardini, T.O. Mentes, M.A. Niño, G. Held, A. Locatelli

"Morphology and composition of Au catalyst on Ge(111)" S. Hajjar, A. Spiesser, L. Josien, C. Renard, G. Garreau, J.L. Bubendorff, T. Maroutian, A. Mehdaoui, D. Bouchier, M. Petit, V. Le Thanh, T.O. Mentes, M.A. Niño, A. Locatelli, C. Pirri

"Electronic interface effects in FeCu alloy films grown on self-assembled Pb islands" F.J. Luque, I. Kowalik, T.O. Mentes, A. Locatelli, R. Miranda, J.J. de Miguel, D. Arvanitis, M.A. Niño

"X ray circular dichroism in adsorbed chiral molecules" J.J. de Miguel, F.J. Luque, I. Kowalik, M.A. Niño, J. Ferrer, D. Arvanitis, R. Miranda

"Formation of a spatially extended intermolecular band for TCNQ molecules on graphene/Ru (0001) studied by means of scanning tunneling spectroscopy" M. Garnica, D. Stradi, S. Barja, C. Díaz, M. Alcamí, A.L. Vázquez de Parga, N. Martín, F. Martín and R. Miranda

"Electronic structure of epitaxial graphene on Ru(0001)" D. Stradi, S. Barja, C. Díaz, M. Garnica, D. Sanchez-Portal, M. Alcami, A. Arnau, A.L. Vázquez de Parga, F. Martín and R. Miranda

"Isomerization reactions controlled by charge-transfer and the self-assembly of organic acceptors on solid surfaces" R Otero, C Urban, J Rodriguez-Fernandez, Y Wang, R Garcia, M A Herranz, M Alcami, N Martin, F Martin, J M Gallego and R Miranda

"New organic reactions at solid surfaces controlled by charge transfer" J Rodriguez-Fernandez, C Urban, Y Wang, R Garcia, M Angeles Herranz, M Alcami, N Martin, F Martin, J M Gallego, R Otero and R Miranda

04-09/09/2012

2nd IUBMB & 37th FEBS Congress. Sevilla, Spain,

Poster

"Unraveling the mechanochemistry of a replicative DNA polymerase" Morín, J.A., Cao, J.M: Lázaro, F.J, Valpuesta, J.M., Salas, M., Carrascosa, J.L., Ibarra, B.

05-06/09/2012

73-International Conference on "Molecular and Medical Imaging" Dublin, Ireland

Invited talk

"Surface functionalized magnetic nanoparticles against cancer" Rodolfo Miranda

05-08/09/2012

2012 World Imaging Meeting, Dublin Ireland.

Oral contribution

"Functionalisation of magnetic nanoparticles for theranostics." A. Lopez-Cortajarena

05/09/2012

III Brazil-Spain Workshop on Organic Chemistry, Instituto de Química, UNICAMP, Campinas, São Paulo, Brazil

Invited lecture

"Phthalocyanines for Molecular Photovoltaics" Tomas Torres

09-13/09/2012

Graphene Nanoscience: from Dirac Physics to Applications, Granada, Spain

Invited lecture

"Experimental Evidence for Acoustic Plasmons in Graphene/Pt(111)" R. Miranda

Oral contributions

"Localized states on graphene quantum dots" S. Barja, D. Stradi, M. Garnica, C. Díaz, B. Borca, A. Arnau, D. Sánchez-Portal, M. Alcamí, A.L. Vázquez de Parga, F. Martín and R. Miranda

"Elastic Response of Graphene Nanodomes by AFM microscopy and spectroscopy in UHV" E. Gnecco, S. Koch, S. Barja, D.StradiTh. , S. Kawai, A.L. Vázquez de Parga, F. Martín, E. Meyer and Rodolfo Miranda

Posters

"Elastic Properties of Epitaxial Graphene from angle-resolved vibrational experiments on phonon dispersion" A. Politano, A.R. Marino, V. Formoso, G. Chiarello, D. Fariasand Rodolfo Miranda

"A perfect mirror for neutral atomic and molecular beams made from epitaxial graphene " M. Minitti1, P. Sutter, E. Sutter, P. Albrecht, A.L. Vazquez de Parga, D. Farias and Rodolfo Miranda

"Intercalation of Pb underneath graphene on Ir(111)" F. Calleja, S. Barja, M. Garnica, A.L. Vázquez de Parga and R. Miranda

"Formation of a spatially extended intermolecular band for TCNQ molecules on graphene/Ru (0001) measure by means of Scanning Tunneling Spectroscopy and DFT calculations" M. Garnica D. Stradi, S. Barja, F. Calleja, C. Díaz, M. Alcamí, A.L. Vázquez de Parga, N. Martín, F. Martín and R. Miranda,

09-14/09/2012

Joint European Magnetic Symposia JEMS 2012 Parma, Italy

Oral contributions

"Engineering the magnitude and the sign of the hysteresis loop shift for in-plane-CoFeB / perpendicular-SmCo5 bilayers" A. Bollero, C. Rodrigo, J. Camarero, V. Neu, M. Seifert, V. Baltz, R.P. del Real, M. Vázquez, B. Dieny, and R. Miranda

"Features of the magnetization reversal mechanisms in the magnetoresistive response of magnetic multilayers" P. Perna, C. Rodrigo, D. Maccariello, M. Muñoz, J.L. Prieto, A. Bollero, J.L. F. Cuñado, M. Romera, J. Akerman, N. Mikuszeit, J. Camarero, R. Miranda

Poster

"Control of the perpendicular anisotropy strength for tuning the exchange-bias in orthogonally coupled ferromagnetic Pt/Co-NiFe bilayers" A. Bollero, V. Baltz, L. D. Buda-Prejbeanu, B. Rodmacq, M. García-Hernández, J. Camarero, R. Miranda, B. Dieny

10-13/09/2012

Workshop on Molecular Electronic Assemblies (FUNMOLS), Newcastle, UK

Oral contributions

'Simultaneous conductance and thermopower measurements of one and two touching fullerenes' Charalambos Evangeli, S. Sherif, E. Leary, M.T. González and Nicolás Agraït

"Stability study of oligo(phenylene ethynylene) molecular junctions" M. T. González, A. Díaz, C. Evangeli, E. Leary, G. Rubio-Bollinger, N. Agraït.

"Towards optimization of the thermal response of iron oxide nanoparticles" C.Casado, H.Takacs, G.Salas, N. Mikuszeit, M.P.Morales, A.Bollero, J.Camarero, F.J. Terán, and R.Miranda

10-14/09/2012

75-International Conference on "Advances in Graphene" Granada, Spain

Invited talk

"A perfect mirror for neutral atomic and molecular beams made from epitaxial graphene"

12-13/09/2012

Fuerzas y Túnel 2012 - FyT2012 El Escorial, Spain

Keynote Lecture

"Identification of all the Intermediate Steps in the Surface-Assisted Oligomerization of π-Extended TCNQ Derivatives" R. Otero

Oral contributions

"Catalytic role of charge-transfer in the cis-trans isomerization of DCNQI on metal surfaces" José M. Gallego, Jonathan Rodríguez-Fernández, Christian Urban, Yang Wang, R. García, Luigi Terrac-

ciano, María Ángeles Herranz, Manuel Alcamí, Fernando Martín, N. Martín, R. Otero, R. Miranda

"Identification of all the Intermediate Steps in the Surface-Assisted Oligomerization of pi-Extended TCNQ Derivatives" Christian Urban, Yang Wang, Jonathan Rodríguez Fernández, Raúl García, M. Ángeles Herranz, Manuel Alcamí, Nazario Martín, Fernando Martín, José M. Gallego, Roberto Otero and Rodolfo Miranda

15-16/09/2012

74-Trends in Nanotechnology Conference (TNT 2012), Madrid, Spain

Invited talk

"Elastic Response of Graphene Nanodomes by AFM microscopy and spectroscopy in UHV" Rodolfo Miranda

16-20/09/2012

Second International Meeting on Organic Materials for a Better Future (Futurmat2), Brindisi, Italy

Oral contribution

"Excited State Engineering of Conjugated Materials by Fluorination" B. Milián

16-21/09/2012

15th European Microscopy Congress. Manchester, Inglaterra.

Oral contribution

"Analysis of Vaccinia virus infection by cryo-X-ray nano-tomography". Chichon, F.J.; Rodríguez, M.J.; Pereiro, E.; Chiappi, M.; Perdiguero, B.; Guttmann, P.; Werner, S.; Rehbein, S.; Schneider, G.; Esteban, M. and Carrascosa, J.L.

16-20/09/2012

FUTURMAT, Riva Marina, Italy

Invited lecture

"Multifunctional Organic Crystals through Secondary Forces" Johannes Gierschner

Oral contribution

"Excited-state engineering of conjugated materials by fluorination" B. Milián-Medina

16-21/09/2012

15th European Microscopy Conference, Manchester (UK)

Invited lecture

"DNA and chromatin imaging with super-resolution fluorescence microscopy based on single-molecule localization". Cristina.Flors

17-21/09/2012

4º Seminario Internacional de Nanociencias y Nanotecnologías. La Habana, Cuba

Invited lecture

"Magnetic nanoparticles for cancer detection and treatment" A. Villanueva

23-25/09/2012

International School & Symposium on Molecular Materials & Devices (ISSMMD2012), Durham, UK

Oral contribution

"Probing the conductance of single molecule using STM" N. Agraït

24-27/09/2012

76-Sino-European Workshop on "Growth and Properties of Graphene, Beijing, China

Invited talk

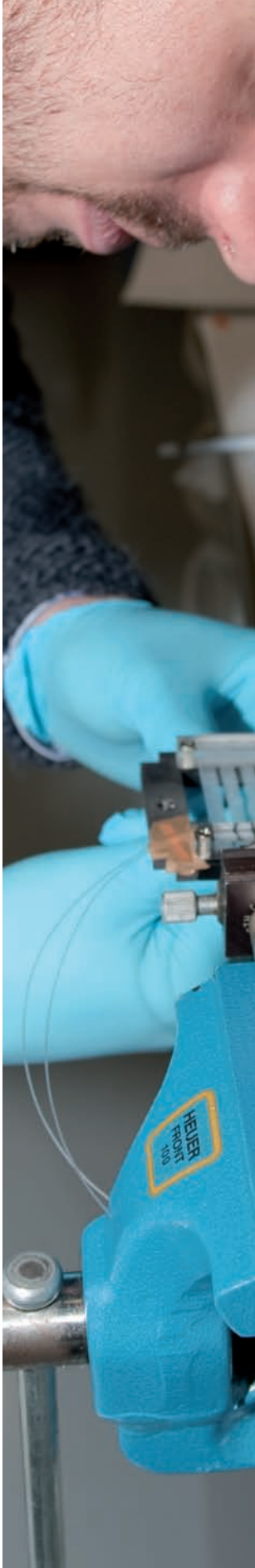
"Experimental Evidence for Acoustic Plasmons in Graphene/Pt(111)" Rodolfo Miranda

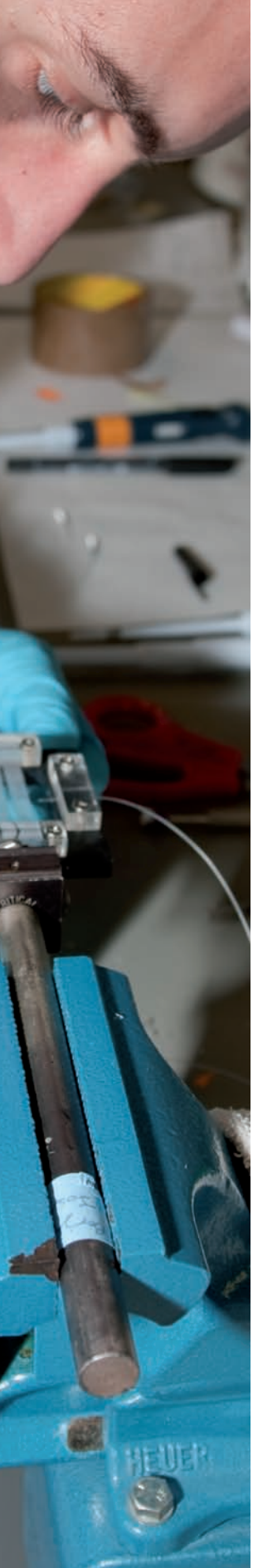
24-28/09/2012

Annual Meeting of the European Optical Society, Aberdeen, UK

Oral contribution

"Organic position sensitive photodetectors based on wedge donor-acceptor layers with complementary thickness" Juan Cabanillas





26-29/09/2012

Conference ESPA, Barcelona, Spain,

Poster

"Computational design of low singlet-triplet gap all-organic molecules for OLEDapplication" Begoña Milián-Medina, Johannes Gierschne

07-12/10/2012

77-13th International Conference on Molecule-based Magnets, Orlando, USA

Invited talk

"Evidence for magnetic order in a purely organic 2D layer adsorbed on epitaxial graphene" Rodolfo Miranda

22-24/10/2012

Multifunctional Hybrids and Organics Conference MAMA-Hybrids, Ischia, Italy

Invited lecture

"Organic position sensitive photodetectors based on wedge donor-acceptor layers with complementary thickness" Juan Cabanillas

Oral contributions

"Circular dichroism of chemisorbed DPED chiral molecule film" M. A. Niño, F.J. Luque, I. Kowalik, D. Arvanitis, R. Miranda, J.J. de Miguel

"Position sensitive photodetectors based on wedge donor-acceptor layers with complementary thickness" Juan Cabanillas

26/10/2012

Symposium A Day on Solar Energy Utilization University of Crete, Department of Chemistry, Iraklion, Crete, Greece

Invited lecture

"Phthalocyanines for Molecular Photovoltaics" Tomas Torres

11-15/11/2012

LEEM PEEM 8, Hong Kong, China

Oral contribution

"Structural and magnetic studies on self-organized metal films" T. O. Mentes, A. Locatelli, N. Stojic, N. Binggeli, M. Á. Niño, L. Aballe, E. Bauer

11-15/11/2012

Optical Instrumentation for Energy and Environmental Applications (E2), OSA Topical Meeting, Eindhoven (NL).

Invited lecture

"Environment Effects on the Long-time Stability of Bulk-heterojunction (BHJ) Organic Photovoltaic Cells" L. Lüer

11-15/11/2012

LEEM PEEM 8, Hong Kong, China

Oral contribution

"Structural and magnetic studies on self-organized metal films" T. O. Mentes, A. Locatelli, N. Stojic, N. Binggeli, M. Á. Niño, L. Aballe, E. Bauer

13-15/11/2012

NANOLITO 2012: Fifth Spanish Workshop on Nanolithography, Donostia-San Sebastián, Spain

Oral contribution

"Magnetic reversal in arrays of nanoscale magnetic islands fabricated by extreme ultraviolet interference lithography" Feng Luo, Laura Heyderman, Harun Solak, Thomas Thomson, Maggie Best

03-07/12/2012

6th International meeting of molecular electronics (ElecMol), Grenoble, France.

Oral contribution

"Stability and breakage mechanism of molecular junctions based on different anchoring groups" M. T. González, E. Leary, C. Evangeli, C. Arroyo, A. Díaz, G. Rubio-Bollinger, N. Agraït.

lectures, seminars, workshops & courses

3.3. Lectures, Seminars, Workshops & Courses (co)-organized by Imdea-Nanociencia

IMDEA Seminars Every Tuesday at 12.00

25-27/04/2012
The 3rd European Nanomanipulation Workshop. IMDEA Nanociencia, Madrid, Spain

18/05/ 2012
2nd Workshop on Nanobioscience. CNB-CSIC & IMDEA Nanociencia, Madrid, Spain

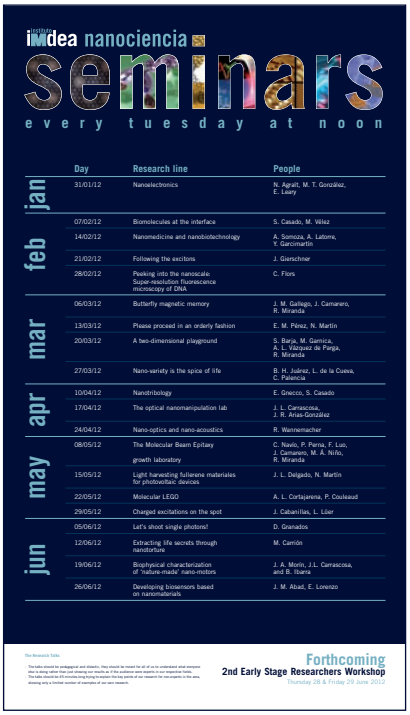
28-29/06/ 2012
2nd Early Stage Researches Workshop in Nanobioscience. IMDEA Nanociencia, Madrid, Spain

22-23/11/ 2012
Kick-off Meeting POCAONTAS. IMDEA Nanociencia, Madrid, Spain

03/12/ 2012
Meeting of the Scientific Advisory Committee. IMDEA Nanociencia *Poster Session*

10-11 & 12/12/2012
Consortium Meeting & Mid-term Meeting MULTI-Fun. IMDEA Nanociencia, Madrid, Spain

12 & 13-14/12/ 2012
Consortium Meeting & Kick-off Meeting NANOPY-ME. IMDEA Nanociencia, Madrid, Spain


instituto imdea nanociencia
seminars
every tuesday at noon
Day
Research line
People
jan
31/01/12
Nanoelectronics
N. Agraït, M. T. González, E. Leary
feb
07/02/12
Biomolecules at the interface
S. Casado, M. Vélez
14/02/12
Nanomedicine and nanobiotechnology
A. Somoza, A. Latorre, Y. Garcimartín
21/02/12
Following the excitons
J. Gierschner
28/02/12
Peeking into the nanoscale: Super-resolution fluorescence microscopy of DNA
C. Flors
mar
06/03/12
Butterfly magnetic memory
J. M. Gallego, J. Camarero, R. Miranda
13/03/12
Please proceed in an orderly fashion
E. M. Pérez, N. Martín
20/03/12
A two-dimensional playground
S. Barja, M. Garnica, A. L. Vázquez de Parga, R. Miranda
27/03/12
Nano-variety is the spice of life
B. H. Juárez, L. de la Cueva, C. Palencia
apr
10/04/12
Nanotribology
E. Gnecco, S. Casado
17/04/12
The optical nanomanipulation lab
J. L. Carrascosa, J. R. Arias-González
24/04/12
Nano-optics and nano-acoustics
R. Wannemacher
may
08/05/12
The Molecular Beam Epitaxy growth laboratory
C. Navío, P. Perna, F. Luo, J. Camarero, M. Á. Niño, R. Miranda
15/05/12
Light harvesting fullerene materiales for photovoltaic devices
J. L. Delgado, N. Martín
22/05/12
Molecular LEGO
A. L. Cortajarena, P. Couleaud
29/05/12
Charged excitations on the spot
J. Caballillas, L. Lüer
jun
05/06/12
Let's shoot single photons!
D. Granados
12/06/12
Extracting life secrets through nanotorture
M. Carrión
19/06/12
Biophysical characterization of 'nature-made' nano-motors
J. A. Morín, J.L. Carrascosa, and B. Ibarra
26/06/12
Developing biosensors based on nanomaterials
J. M. Abad, E. Lorenzo
Forthcoming
2nd Early Stage Researchers Workshop
Thursday 28 & Friday 29 June 2012


3rd european nanomanipulation workshop
madrid
april 25-27
2012
Auditorium, IMDEA Nanociencia
c/ Faraday, 9. Campus Cantoblanco. UAM
Invited Speakers
Local Organizing Committee
Scientific Committee


2nd workshop
on nanobioscience
CNB CSIC - IMDEA NANOCIENCIA
18th May, 2012
Auditorium, IMDEA Nanociencia
c/ Faraday, 9. Campus Cantoblanco. UAM
www.nanociencia.imdea.org
www.cnb.csic.es
Keynote speakers
Prof. Claire Wyman
Erasmus Medical Center, Rotterdam, The Netherlands
Prof. Erik Schaeffer
Biotechnology Center, TU Dresden, Germany
Invited speakers
Organized by
Sponsored by


www.esrworkshop2012.com
instituto imdea nanociencia
28-29 june
thursday - friday
2nd early stage researchers workshop in nanoscience
instituto imdea nanociencia · c/ faraday, 9 · campus cantoblanco
Invited Speakers


POCAONTAS ITN NETWORK
KICK OFF MEETING


instituto imdea nanociencia
meeting of the scientific advisory committee
monday, december 3rd, 2012
9.15 - 10.00
Presentation
IMDEA Nano in a nutshell (2008-2012)
Prof. Rodolfo Miranda
Director IMDEA Nanociencia
10.00-11.15
Dr. Larry Lüer
Towards highly efficient and stable organic solar cells: insights from time-resolved spectroscopy
Dr. Emilio Pérez
Unconventional methods of modification of carbon nanotubes
Dr. Francisco Terán
Magnetic nanoparticles for cancer detection and elimination
Dr. Enrico Gnecco
The Nanotribology Lab @ IMDEA Nanociencia
Dr. A. L. Vázquez de Parga
Periodically Nanostructured Graphene
11.15-11.30
Coffee break
11.30-13.00
Poster Session and Visit to the Labs
13.00-14.00
Lunch
14.00-15.30
Evaluation of researchers
Dr. Johannes Gierschner
Dr. Alberto Bollero
Dr. Ricardo Arias
16.00- 18.30
MEETING OF THE SCIENTIFIC ADVISORY COMMITTEE
Evaluation of the Institute and Researchers
Deliberation of the SAC
Discussion with the Director
Deliberations and writing of the report
21.00
Dinner
IMDEA Nanociencia building, C/ Faraday 9, Cantoblanco Campus UAM


multifun
Multifunctional Nanotechnology for Selective Detection and Treatment of Cancer
Large-scale integrating Collaborative Project · Grant agreement nº: 262943
12 diciembre 2012, Madrid, Spain
1st review
imdea nanociencia
IMDEA Nanociencia building, C/ Faraday 9, Cantoblanco Campus UAM


nanocrystalline permanent magnets based on hybrid metal-ferrites
(Project no.: 310516)
Wednesday 12th December 2012
Consortium Meeting
6 months Action Plan: December 2012 – May 2013
SCIENTIFIC PLANNING
TECHNOLOGICAL PLANNING
DISSEMINATION & EXPLOITATION
SCIENTIFIC AND ADMINISTRATIVE COORDINATION
imdea nanociencia
IMDEA Nanociencia building, C/ Faraday 9, Cantoblanco Campus UAM

03/02/2012
Tomas Torres "Phthalocyanines: old dyes, new molecular materials" School of Chemical Sciences, University of Auckland, Auckland, New Zealand

08/03/2012
M. T. González "Study of single-molecule junctions using a Scanning Tunneling Microscope', Columbia University – New York , USA.

08/03/2012
Tomas Torres "The Significance of Phthalocyanines in Molecular Photovoltaics" Center for Molecular Organic Chemistry, Nanjing University, Nanjing, China

22/03/2012
Tomas Torres "Phthalocyanines: Old Dyes, New Molecular Materials" The Scripps Research Institute, La Jolla, California, USA

23/03/2012
Tomas Torres "Photoactive Phthalo- and Subphthalocyanine- Containing Ensembles" University of California, San Diego (UCSD), La Jolla, California, USA

02/04/2012
Tomas Torres "Phthalocyanines: old dyes, new molecular materials. Applications in Molecular Photovoltaics" University of California, San Diego (UCSD), La Jolla, California, USA

04/04/2012
Tomas Torres "Phthalocyanine-Carbon Nanoestructures: Covalent and Supramolecular Ensembles" University of Texas at El Paso, Department of Chemistry El Paso, TX, USA

05/04/2012
Tomas Torres "Can something that is called Sub be Super? The case of Subphthalocyanines" University of Texas at El Paso, College of Science

31/05/2012
Tomas Torres "Phthalocyanines: old dyes, new molecular materials" Gebze Institute of Technology, Çayırova, Gebze-Kocaeli, Turkey

01/06/2012
Tomas Torres "Can something that is called Sub be Super? The case of Subphthalocyanines" Gebze Institute of Technology, Çayırova, Gebze-Kocaeli, Turkey

15/06/ 2012
JL Carrascosa "Cryo- X-ray tomography of virus infected cells: Bridging a resolution gap". STFC Rutherford Appleton Laboratory. Harwell Science and Innovation Campus. Oxford, Great Britain

28-29/06/ 2012
L. Luer "Femtosecond probing of organic optoelectronic devices" Institut de Physique et Chimie des Matériaux (IPCMS) at CNRS Strasbourg, France

03/07/ 2012
L. Cortajarena "Bio-functionalization of magnetic nanoparticles for cancer diagnosis and treatment" Department of Chemistry.Virginia Tech University, USA

14/09/2012
B. Milián-Medina "Polyconjugated Organic Materials for Opto-electronic Applications: Quantum-Chemical Study of Structure-Properties Relationships" Univ. Napoli, Italy

19/09/2012
L. Luer, "Modeling degradation on a variety of levels: the ESTABLIS approach". Invited tutorial at workshop of the ESTABLIS European network, Nuernberg Germany

23 /09 2012

Borja Ibarra "DNA replication dynamics at single molecule level Dpt. of Biochemistry & Molecular Biology. Michigan State University, USA

26/09/2012

L.Lüer, "Carbon nanotubes in organic photovoltaics: Achievements, bottlenecks, and output", Invited tutorial at Workshop on Nanocarbon Optics, WNC=2012, Niederstetten, Germany

25/10/2012

Borja Ibarra "Manipulación de moléculas individuales de la DNA polimerasa del fago Phi29" II Reunión de la Red española de bacteriófagos y elementos transductores (FAGOMA), Mallorca, Spain

26/12/2012

Tomas Torres "Phthalocyanines: old dyes, new molecular materials" Department of Chemistry, Isfahan University, Isfahan, Iran

3.4. Projects

3.4.1. International programs

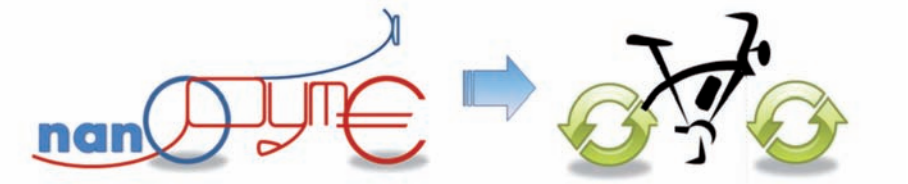
NANOPYME

"Nanocrystalline Permanent Magnets Based on Hybrid Metal-Ferrites"

Funding: FP7-NMP-2012-SMALL-6 nº 310516
Partners: Consortium of 11 European partners coordinated by IMDEA Nanociencia
Duration: 2012-2015
Coordinator: Dr. Alberto Bollero
http://nanopyme-project.eu/

Permanent magnets are key elements of technological devices used in motors, generators, information storage and many more nowadays applications. E.U. industries depend critically on the production of such type of magnets which are based on rare-earths metals. However most of the mines and reserves of rare-earths are controlled by emerging countries (mainly China) that started recently to develop their own technological devices instead of simply exporting the raw materials. Moreover E.U. companies do not produce rare-earth magnets. Rare-earths represent the group with the highest supply risk.

NANOPYME addresses the design and development of permanent magnets without rare-earths, consisting on hybrid nanostructures based on metals and ferrite oxides. Project relies on key advances in the fields of nanoscience, materials fabrication and processing. These newly designed rare-earth free permanent magnets will guarantee their use in a broad spectrum of technological applications which are currently covered by more expensive low energy-range rare-earth permanent magnets. This is crucial in order to allow E.U. technological companies to be competitive in the global market.

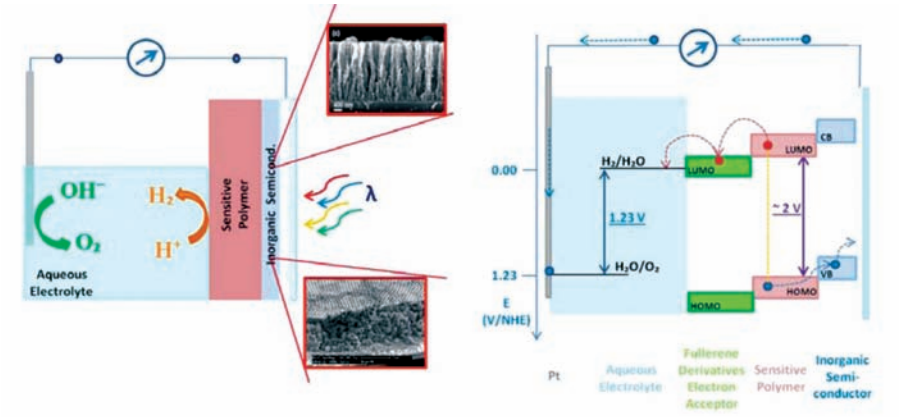


PHOCS

"Photogenerated Hydrogen by Organic Catalytic Systems"

Funding: FP7-ENERGY-2012-1-2STAGE n° 309233
Partners: Consortium of 7 European partners coordinated by the Fondazione Istitute Italiano di Technologia, Geneve, Italy
Duration: 2012-2015
Principal Investigators: Dr. Nazario Martin & Dr. Juan Luis Delgado

Aim of the project "Photogenerated Hydrogen by Organic Catalytic Systems (PHOCS)" is the realization of a new-concept, photoelectrochemical system for hydrogen production, based on the hybrid organic/inorganic and organic/liquid interfaces. PHOCS takes the move from the recent demonstration of reduction/oxidation reactions taking place, under visible light and at zero bias, at the interface of an organic semiconductor and an aqueous electrolyte, obtained by the coordinator's group. PHOCS intends to combine the visible-light absorption properties of organics, together with the enhanced charge transport capabilities of inorganic semiconductors, in order to build a hybrid photoelectrode for hydrogen generation. New organic donor and acceptor materials (conjugated polymers and fullerenes derivatives) will be synthesized, properly tuning HOMO-LUMO levels position and energy gap extent for semi-water splitting purposes. Final aim of PHOCS project is the realization of a solar-to-hydrogen energy conversion efficient device, as a tangible first step towards the new "organic water splitting" technology.



(Left) Schematic of the hybrid organic/inorganic water splitting system. The visible light sensitive polymer is put directly in contact to an aqueous electrolyte and coupled the nanostructured inorganic semiconductor electrode. (Right) Representative energy level diagram for the final hybrid, photoelectrolytic device.

POCAONTAS

"Polymer-Carbon Nanotubes Active Systems for Photovoltaics"

Funding: FP7-PEOPLE-2012-ITN nº 316633
Partners: Consortium of 9 European partners coordinated by IMDEA Nanociencia.
Duration: 2012-2016
Coordinator: Dr. Larry Luer

The goal of the POCAONTAS network is to offer training opportunities to 14 research fellows in the field of of organic solar cells based on blending organic materials with carbon nanotubes. Polymer-Carbon Nanotubes Active Systems for Photovoltaics (POCAONTAS) is a training network coordinated by IMDEA Nanoscience that brings together top European players in the field of Organic Solar Cells (OSC) offering a unique opportunity for research career development. POCAONTAS will train a total of 14 researchers in the development of highly efficient and stable OSC based on tailored blends of polymers with single wall carbon nanotubes (SWNT) that are well suited for OSC due to their inherent extremely high stability, high carrier mobility and tunabilityof optical gaps.

ESTABLIS

"Ensuring STABiLIty in organic Solar cells"

Funding: FP7-PEOPLE-2011-ITN nº 290022
Partners: Consortium of 9 European partners coordinated by the University of Pau and the Pays de L´Adour, France.
Duration: 2012-2015
IMDEA Research Team: Dr. Larry Luer
http://www.project-establis.eu/

The ITN ESTABLIS will train a team of 11 PhD Fellows and 4 Postdoctoral Fellows Establis in the development of materials and techniques for cheap, flexible and stable organic solar cells (OSCs). The task of IMDEA within the EU network ESTABLIS is to understand how degradation in organic solar cells influences the photovoltaic event chain, that occurs on time scales from 100 fs (charge transfer) up to microseconds (charge extraction).

Consequently, the first step was to build up and optimize our main research tools: microsecond pump-probe spectroscopy, photo-induced absorption spectroscopy and femtosecond spectroscopy. The set-up for microsecond pump-probe spectroscopy has now a noise level in the 10^-7 region, and is thus internationally competitive. Moreover, a set up for time

resolved photovoltage has been built up, in order to benchmark electrical and optical information from the solar cells under study. One of our aims is to understand why oxygen reduces OSC's efficiency. Fig. 1 shows how the presence of oxygen reduces the extraction of charge carriers in OSCs.

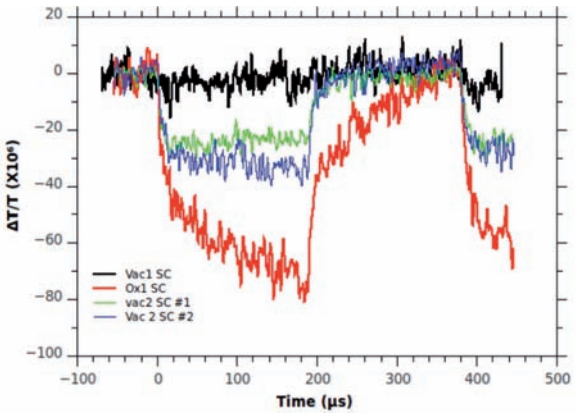


Fig.1. Optical detection of charge carriers in an organic solar cell under short circuit (SC) conditions via their induced absorption (negative differential transmission, ΔT/T, at 980nm. A highly efficient pristine solar cell (black curve) does not accumulate charges at all, because of efficient extraction. After oxygen sorption (red curve), a strong charge accumulation is found after light on at 0 µs, clearly showing that extraction is no longer complete. The process is partially reversible after annealing in vacuum (Vac2) (green and blue curves). Karuthedath, et al., to be published.

European Research Council
Established by the European Commission

MINT

"Mechanically Interlocked Carbon Nanotubes"

Funding: ERC-2012-StG_20111012 nº 307609
Duration: 2012-2017
Principal Investigator: Dr. Emilio Pérez

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, the self-assembly of electroactive materials and the synthesis and characterization of mechanically interlocked molecules.

NANOTEST

"Fabrication and development of nanotoxicology-test bacterial arrays for the investigation of antibiotics against multi drug-resistant bacteria"

Funding: FP7-PEOPLE-2010-IOF nº 275148
Duration: 2012-2015
Principal Investigator: Dr. Ramses V. Martinez

Bacterial resistance to antibiotics is one of the most important problems to be solved in medicine. Most antibiotics are effective against 99.9% of the target microorganisms. However, the remaining ones carry mutations that allow resistance against that particular drug which are transmitted to their progeny, making them immune to the treartment.Therefore, new strategies are necessary for the design of antibiotics able to circumvent bacterial resistance.

During the last decade we have developed many nanoscale systems to effectively transport drugs whose efficiency has not been properly evaluated due to the lack of a reliable technique for individually confining microbes. During the last year, our research has been focused on the development of a new toxicological test based on individual confinement bacteria. We have developed microfluidic systems for microbiology applications using soft lithography. By combining micro-printing of bacteria with microfluidic devices a new generation of toxicology tests for bacteria have been developed (See Figure 1) which will help to study the toxicological effects of certain medications using nanoparticles with small bacterial colonies.

In order to deposit small bacterial colonies on a flat substrate (sealed by the microfluidic system) the microcontact printing (MCP) technique will be used. Subsequently, the devise will be closed by inserting a number of microfluidic channels which then will by used to flux different concentrations of antibiotic to establish its toxological effect on the printed bacteria .

At present, the research is focused on testing the proper periodicity of the microfluidic channels, to maximize the interaction of the printed bacteria (currently, the *E.coli* AW405 strain) with different fluids introduced in the microfluidic device.

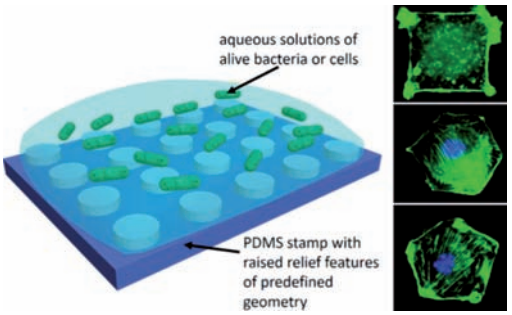


Figure 1. Left: Method for the patterning alive bacteria or cells using micro-contact printing. Right: Confocal microscope images showing the control on the shape of the printed cells. Each cell has a surface of approximately 900 μm²) Images obtained by fluorescence microscopy of cells confined to various shapes (all with areas of 900 μm²). The cells were stimulated with PDGF and stained with phalloidin and 4'-6-Diamidino-2- phenylindole to visualize F-actin (green) and nuclei (blue).

Organic position sensitive photodetectors

Funding: Chinese Scholarship Council Call 2011
Duration: 2012-2016
Principal Investigators: Dr. Juan Cabanillas, Dr. Feng Luo, Dr. Miguel Angel Niño & Dr. Paolo Perna

This research line aims at developing organic photodetectors based on multilayer small molecules which deliver a linear change in photocurrent depending on the position of the impinging light on the pixel. The idea to produce spatial tuning of photocurrent in one single pixel exploits optical interference in multilayer structures as well as antibatic photocurrent response [1]. We have recently developed devices able to monitor lateral displacements with a spatial sensitivity close to 500 mm [2].

[1] J. Cabanillas-Gonzalez and M. Campoy-Quiles, PCT/ES2011/070841.
[2] J. Cabanillas-Gonzalez et al., Appl. Phys. Lett. 99, 103305 (2011).

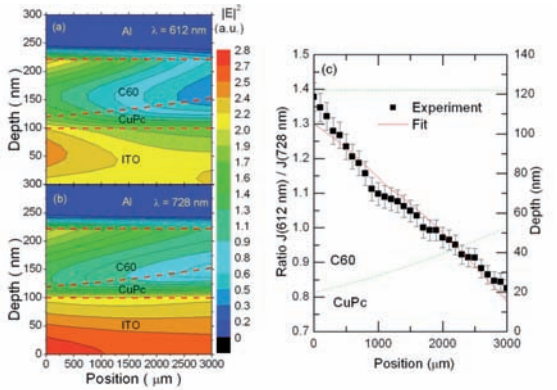


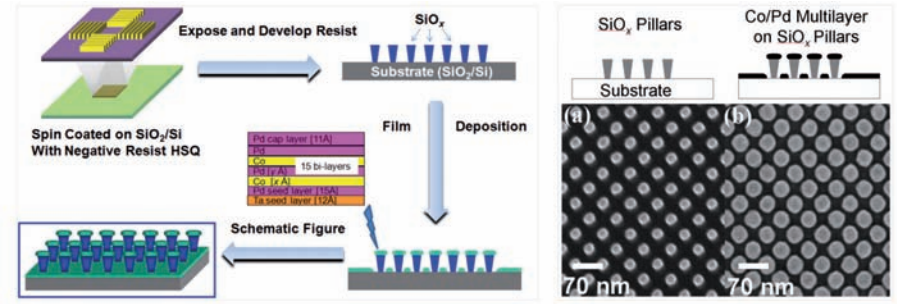
Figure. (Left) Optical modelling of the in-depth distribution of light across a multilayer photodetector. (Right) Dependence of photocurrent as a function of position.

"Multilevel magnetic recording in bit patterned media for areal densities above 5 Terabit-per-square-inch"

Funding: Chinese Scholarship Council Call 2011
Duration: 2012-2016
Principal Investigator: Dr. Feng Luo

The project aims at developing a new magnetic recording media at a proof-of-concept level for ultrahigh density magnetic storage applications, by using low-cost, environmentally friendly processes, and both advanced and new nanotechnologies.[1] It has been shown that 40 nm period island arrays with almost perfect ordering on flat SiO2 substrate surfaces can be achieved and 25 nm period patterns have already been demonstrated. With further reducing the dimension of the interference mask of EUV-IL or optimizing the e-beam lithography parameters, the sub-20 nm period pattern can be achieved. [2-3]

[1] F. Luo, L.J. Heyderman, H.H. Solak, T. Thomson, and M.E. Best, Appl. Phys. Lett. 92 ,102505 (2008).
[2] P. Kanberberger, F. Luo, et al, Applied Physics Letters, 95, 023116 (2009).*
[3] F. Luo, et al, J. Nanosci. Nanotechnol., 12, 2484 (2012).*



Figures: (Left) Schematic Figure of fabrication of patterned magnetic arrays; (Right) SEM image of 50 nm-period SiOx pillars and magnetic dot arrays

Other research projects currently running at IMDEA Nanociencia Institute are:

MULTIFUn

"MultiFunctional Nanotechnology for Selective Detection and Treatment of Cancer"

Funding: FP7-NMP-2010-LARGE-4 nº 262943-2
Partners: Consortium of 16 European partners coordinated by ATOS Origin and IMDEA Nanociencia (Scientific coordination)
Duration: 2011-2015
Principal Investigators: Dr. Rodolfo Miranda, Dr.Francisco Terán, Dr.Aitziber López-Cortajarena & Dr.A. Somoza

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 (MNP) to selectively target and eliminate breast and pancreatic cancer (stem) cells. The improved magnetic features of the **MultiFun** MNP will lead to medical applications such as contrast agents and magnetic heating inductors. Moreover, MNP can be functionalised with ligands in order to facilitate tumour diagnosis by MRI. Targeting peptides and antibodies will be employed against cancer (stem) cells leading to early cancer detection, an increase of the effectiveness and reducing side effects. The same MNP will be used simultaneously as functional nanocarriers and heating inductors in order to provide a multimodal therapeutic modality. The synergistic effects of drugs, peptides, small RNAs and heat will be evaluated to determine the effectiveness of different therapeutic combinations.

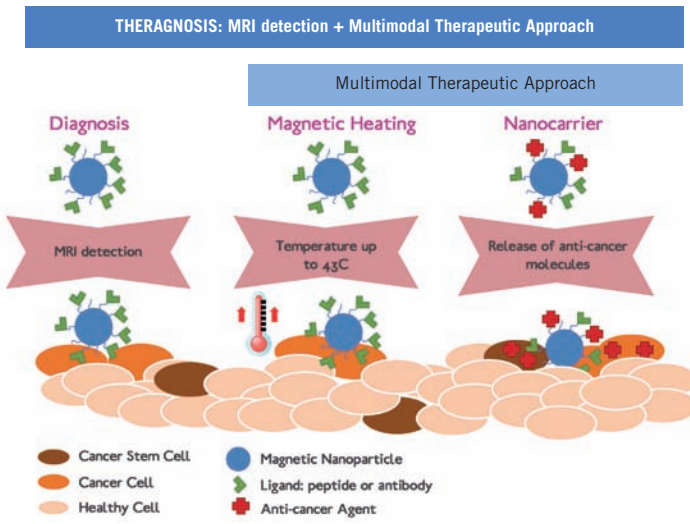


Figure 1: schematic representation of the MNP functionalities related to the theragnostic approach.

MAMA

"Unlocking research potential for multifunctional advanced materials and nanoscale phenomena"

Funding: FP7-REGPOT-2010-1 nº 264098
Partners: Consortium of 11 European partners coordinated by the CNR-SPIN, Italy
Duration: 2010 -2014
Principal Investigators: Dr. Rodolfo Miranda & Dr. Paolo Perna
http://mama.spin.cnr.it/

Multifunctional materials are defined as those materials that perform specific functions other than possessing a load bearing capacity. Examples include semiconductors, magnetic materials, piezoelectric 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 magneto-resistance, multi-ferroicity and a number of exotic magnetic, charge and orbital orderings. Still, the analysis and modelling of hybrid heterostructures, where layers of functional organic materials represent 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 nano-scale 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 hetero-structures 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.

ONDA

"Ordered heteroand Nano-structures with Epitaxial Dielectrics for magnetic and electronics Applications"

Funding: FP7-PEOPLE-2009-IRSES nº 247518.
Partners: Consortium of 7 European partners coordinated by the University of Modena and Reggio Emilia (Italy) and IMDEA Nanociencia (Scientific coordination)
Duration: 2010-2014
Principal Investigators: Dr. Rodolfo Miranda & Dr. Julio Camarero

The objective of the project is to strengthen the research cooperation between EU and Russia in the strategic field of ultrathin nano-structured materials for advanced electronic applications through a program of exchange of researchers.

One of the goals of the project is the training of the exchanged researchers into experimental techniques and procedures that are commonly not applied at their parent institutions. For instance, early stage/young researchers, that are undertaking their professional formation, benefit of the exchange opportunity to expand their knowledge and to increase their opportunity of career development.

ONDA scientific activity regards the realization and study of ultrathin layered dielectric materials based on inorganic dielectrics (mainly fluorides on semiconductors), to promote the growth of suitable classes of materials, such as magnetically ordered hetero- and nanostructures or organic thin films for molecular electronics.

The IMDEA team, shares their expertise and skills in surface science and nanomagnetisms. We perform/train quasi-static and dynamic investigations of the magnetization reversal processes in the developed magnetic nanostructures. Both anisotropies and reversal mechanism are identified by using our home-made high resolution variable temperature vectorial magneto optic Kerr effect magnetometry set-up, with time, angular, temperature and vectorial resolution capabilities.

BIONANOTOOLS

"Protein design to generate bio-functional nanostructures"

Funding: FP7-PEOPLE-2009-IRG nº 246688
Duration: 2010-2014
Principal Investigators: Dr. Aitziber López-Cortajarena

The main objective of this 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, focuses 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.

We 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.

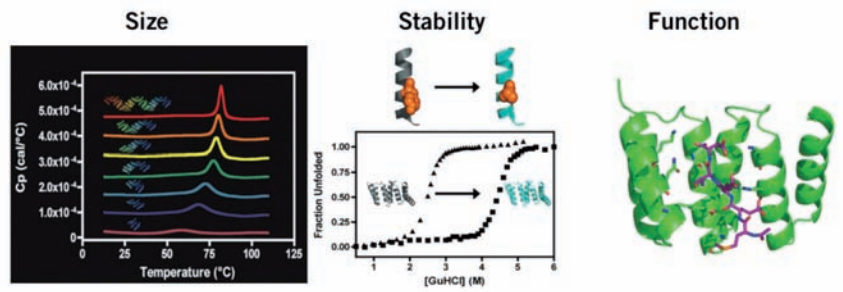


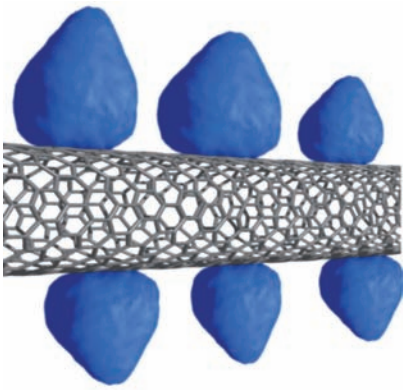
Fig 1. Bionanotools generation. Protein design for generation of tailored properties and modification of size, stability and function.

DOTUBE

Interactions between semiconductor nanoparticles and carbon nanotubes

Funding: FP7-PEOPLE-2009-ERG nº 239256
Duration: 2009-2012
Principal Investigator: Dr. Beatriz Hernández

The aim of the DOTUBE proposal (ERG 239256) was to study the interaction between CdSe semiconductor nanoparticles (quantum dots) and carbon nanotubes. These hybrid systems attract considerable attention due to the photoconductive response obtained upon optical excitation. A good understanding of such interaction has been achieved from the synthetic point of view by studying the reactivity of CdSe nanoparticles prepared in the absence or presence of several halogenated co-solvents.



The nanoparticles have been studied by means of nuclear magnetic resonance spectroscopy and X-ray photoelectron spectroscopy, among other techniques. Furthermore, the effect of the co-solvent on the nucleation, growth and/or interaction with carbon nanotubes has been evaluated for other types of nanoparticles such as ZnO, PbS, alloyed metals (PtFe) or combination of semiconductor and metals (CdSe/Au).

CUSPFEL

"Chemistry with Ultrashorts Pulses and Free-Electron Lasers: looking for control strategies through *exact* computations"

Funding: European Science Foundation.COST Action. CGA-CM0702
Duration: 2008-2012
Principal Investigator: Prof. Fernando Martín

The advent of xuv and x-ray ultrashort pulses produced by free-electron lasers and high harmonic generation has opened up the way to a new chemistry at the femto and attosecond time scales. Processes such as ionization and dissociation can now be monitored in real time, which can be used to develop novel control strategies of chemical reactions. For atoms and simple molecules, the implementation of nearly exact theoretical methods in supercomputers has made it possible to guide experimental research in this area. Such methods lie outside the traditional quantum chemistry realm since, e.g., they must accurately reproduce the time evolution of the electronic and nuclear motion, including both excited and continuum states. The necessary extension to complex systems, like many-electron atoms, molecules and nanoparticles, has required the joint efforts of the leading European groups included in this Action.

MRLSMO

"LSMO based magnetoresistive sensors"

Funding: CNRS Projet de coopération PICS 2012 France / Espagne N° Système: 157683
Duration: 2012-2014
Principal Investigator: Dr. Paolo Perna

The MRLSMO project is a cooperation project financed by the CNRS that focuses on the fabrication and characterization of half metallic perovskitic oxide La0.7Sr0.3MnO3 (LSMO) based magnetoresistive sensors. The project is established between the GREYC (CNRS-UMR 6072) laboratory and the Nanomagnetism's group at IMDEA Nanociencia Institute. With the aim of optimizing the magnetoresistive performances of the LSMO-

based structures, we plan to investigate all the aspects concerning the fabrication of devices, i.e. thin film deposition and photolithography, structural characterization of materials, study of the magnetic properties (magnetic anisotropy), magnetoresistance and noise measurements.

The strength of the project relies on the multidisciplinarity of the partners in electrical engineering for GREYC and in nanomagnetism physics for IMDEA Nanociencia.

The two groups already demonstrated a strong scientific collaboration as demonstrated by several common publications on the investigation of the magnetization reversal processes, on the magnetic anisotropy and on the magnetoresistive response in this system.

SIESPER

"Towards perpendicular spintronic devices: magnetization reversal processes in out-of-plane exchange biased nanostructures"

Funding: Spanish Ministry of Science and Innovation (Fundamental Research Programme). MAT2011-25598.
Duration: 2012-2014
Principal Investigator: Dr. Alberto Bollero

Advances from Materials Science, Physics and Engineering have led to dramatic improvements in information technology applications (hard disks, magnetic memories, sensors,…). In particular, an important effort has been done along the last decades by scientific and industrial research groups to increase the magnetic memory storage density through further miniaturization of devices.

SIESPER focuses on the study of the magnetization reversal processes in continuous and nanostructured multilayers prepared by sputtering and by molecular beam epitaxy. This goes through a successful understanding of, among others, the relevance of the preparation conditions (deposition parameters, patterning process…) on the final microstructural and magnetic properties of the nanostructured films together with effects due to the physical reduced sizes of the nanostructures. These aspects are of fundamental importance in the final performance in practical technological applications such as sensors (read heads,).

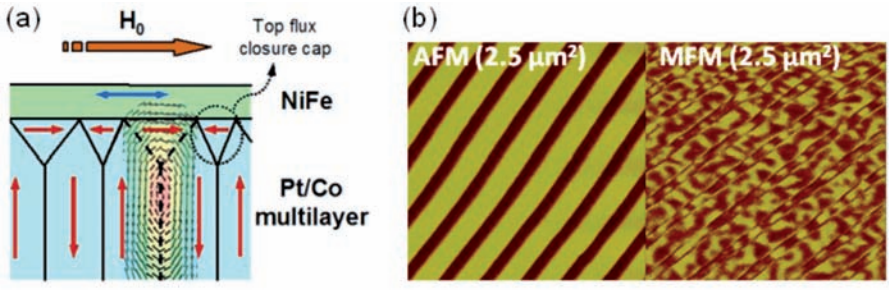


Figure. (a) Unequal closure domains configuration responsible of the phenomenon of exchange-bias observed in a ferromagnetic-ferromagnetic bilayer. (b) AFM (left) and MFM (right) images showing the topography and magnetic domain configuration, respectively, for nanostructures (lines) of the magnetic system shown in (a).

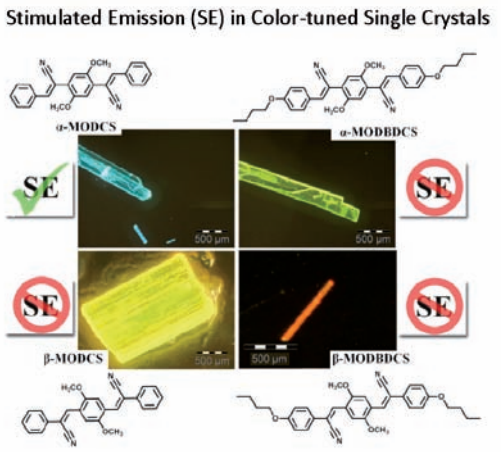
CONMOL

"Tailor-made Conjugated Molecular Materials via Intra- and Intermolecular Control"

Funding: Spanish Ministry of Science and Innovation (Fundamental Research Programme). CTQ2011-27317.

Duration: 2012-2014

Principal Investigators: Dr. Johannes Gierschner (PI), Dr. Larry Lüer & Dr. Begoña Milián-Medina



The rational design of conjugated organic materials for opto-electronics with defined electronic, optical and photophysical properties in the solid state suffers from the complex interplay of intra- and intermolecular contributions, and from disorder usually found in polymeric samples. CONMOL thus explore structurally and electronically well-defined oligomeric materials forming single crystals. Experimental photophysical studies, hand-in-hand with advanced structural characterization and quantum-chemical calculations provide an in-depth understanding of solid state exciton signatures and their fate, and how this ultimately controls the emissive and multi-stimuli response in organic materials. This opens the path towards the design of supramolecular assemblies through specific secondary forces for bright emissive, color-tunable organic crystals, showing superior lasing, sensing, or charge transport properties.

SIMMA

Synthesis of Advanced Molecular Machinnery

Funding: Spanish Ministry of Science and Innovation (Fundamental Research Programme). CTQ2011-25714.
Duration: 2012-2014
Principal Investigator: Dr. Emilio Pérez

We intend to investigate the possibility of synthesizing "molecular swimmers" molecules capable of moving directionally faster than diffusion. To do that, we have designed a series of designs based on the three linked spheres model, extensively investigated from the theoretical point of view. This system can be adapted to synthetically accessible targets based on lasso-type interlocked molecules. A second part of the project is dedicated to the synthesis of molecular machinery based on single wall carbon nanotubes. In particular we plan to synthesize rotaxanes based on SWNTs.

COLSOLAR

Organic Dyes for the Preparation of solar cells (DSSC Dye Sensitized Solar Cells).

Funding: Spanish Ministry of Science and Innovation (Fundamental Research Programme). CTQ2011-27934.
Duration: 2012
Principal Investigator: Dr. Juan Luis Delgado

The development of new dyes for the preparation of Dye Sensitized Solar Cells, is a hot topic, due to the increassing global energy demand, which produce enhanced depletion of fossil fuels reserves, leading to further aggravation of the environmental pollution.

So far, a few examples of DSSC leading to power conversion efficiencies (PCE) of 11 % have been described, although further research is needed, in order to increasse the PCE and the stability of the devices.

In this research project, from a chemical viewpoint, we describe the reasonable synthesis of new dyes, based on metallic complex, organic compounds and quantum dots, in order to increase the capability of these systems to harvest sunlight and therefore prepare new efficient photovoltaic devices.

Here we propose the synthesis of new mono and dinuclear metalic complexes, bearing light harvesting moieties, in order to increase the capability to harvest sunlight of these compounds and therefore the PCE.

Other proposed approach consist on the synthesis of new acceptor units for the preparation of Donor-π-Acceptor systems, with stronger charge transfer properties, in order to increase the light harvesting proeprties of these systems.

Finally, we will use quantum dots as sensitizers in the preparation of DSSC. Through suitable control of the size we expect to control the absorption properties of the QD, and therefore increase the efficiency of the devices.

FASAMEX

Friction at the Nanoscale: anisotropy effects and influence of mechanical excitations

Funding: Spanish Ministry of Science and Innovation (Fundamental Research Programme) MAT2011-26312
Duration: 2012
Principal Investigator: Dr. Enrico Gnecco

The main goal of this project was to study anisotropy effects in atomic-scale friction. The investigated surfaces included carbonate minerals, alkali halides, graphene and organic molecules self-assembled on crystal surfaces. An example is given in Fig. 1, where a friction map of CuPc molecules grown on dolomite is shown. Most of the experimental results could be reproduced using the Prandtl-Tomlinson model.

We have also performed nanomanipulation experiments to estimate the shear stress required to detach heteroepitaxially grown nanoislands (Fig. 2) and to relate the trajectories of nanoparticles to the friction force between particles and substrate (Fig. 3). The samples consisted in carbonate minerals and in metal or metalloids deposited on solid lubricants such as MoS2 and graphite.

The influence of mechanical vibrations on friction and the use of anisotropic substrates for nanomanipulation will be systematically explored in the continuation of this bridge project, which retains the same name.

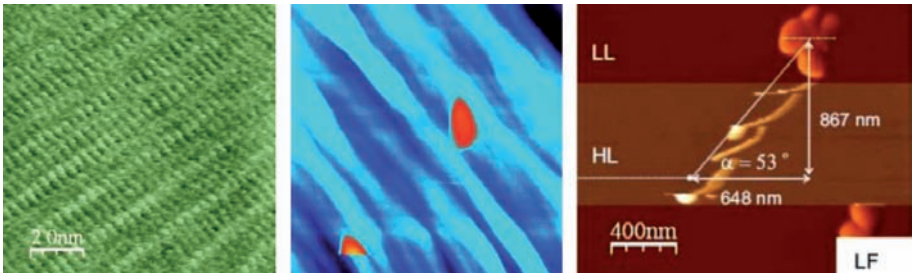
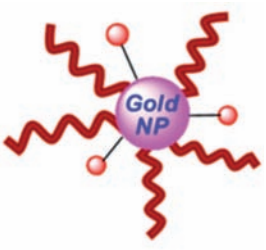


Fig. 1. Friction force map of CuPc molecules on dolomite (104) in water; Fig. 2. Detachment of a calcite island from a kutnahorite substrate; Fig. 3. AFM manipulation of Sb islands on a MoS_2 substrate.

NanoOligo

Modified Oligonucleotides in Nanomedicine: gene detection and gene inhibition by RNA interference



Funding: Spanish Ministry of Science and Innovation (Fundamental Research Programme). SAF2010-15440.
Duration: 2011-2013
Principal Investigator: Dr. Álvaro Somoza

Oligonucleotides are excellent materials in nanotechnology due to their reduce size (within the nanometer scale) and their assembly capabilities that allow the preparation of very complex structures based on DNA or the assembly of assorted nanostructures. Oligonucleotides have a great potential in nanomedicine as well since they can be employed in the preparation of nanostructures for the detection and/or regulation of genes involved in diseases.

In this project we aim to develop gene sensors and control the gene expression using gold nanoparticles modified with oligonucleotides.

Gold nanoparticles have interesting optical properties due to the surface plasmon resonance. These nanostructures have a reddish color when are well dispersed but it turns bluish when are aggregated. Based on this phenomenon we will prepare sensors for single-point mutations that are associated with cancer.

On the other hand, gold nanoparticles can be used as delivery system, particularly, we will functionalize gold nanoparticles with small interferin RNAs (siRNA) to block the expression of genes involved in cancer. The functionalized nanostructure will be able to reach the cancer cells, cross the cell membrane and release the siRNAs to inhibit the selected oncogenes.

POLYDYE

"Conjugated polymer based optical amplifiers for chemical sensing"

Funding: Spanish Ministry of Science and Innovation (Fundamental Research Programme). TEC2010-21830-C02-02.
Duration: 2011-2013
Principal Investigator: Dr. Juan Cabanillas

Conjugated polymers have several properties which makes them highly suitable for optical sensing. Examples are high photoluminescence quantum yield in solid state, notable

optical gain properties, exciton diffusion lengths exceeding 10 nm and ease of processing into waveguides and laser resonators. Exploiting ASE emission of conjugated polymers in waveguides for sensing has the advantage of increasing the sensitivity to fluorescence quenchers compared to conventional fluorescent sensors since non linear emission is dramatically reduced by their presence at the polymer surface. In this project we develop rib planar waveguides based on polyfluorene with widths comprised between 20 and 200 µm and 800 nm height. Typical analytes targeted are NO2 and amines. Capping of the polymer waveguide with monolayers of photoactive molecules is investigated as a way to fine tune the sensitivity and selectivity of the waveguide sensor.

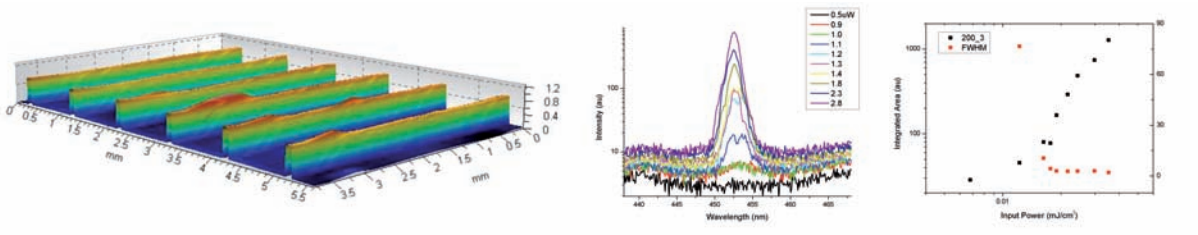


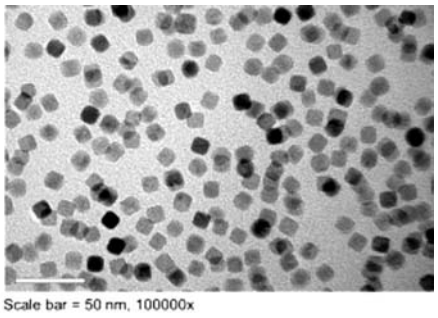
Figure (from left to right): Topography image of 100 µm waveguide ribs. ASE emission characteristics as a function of excitation fluence.

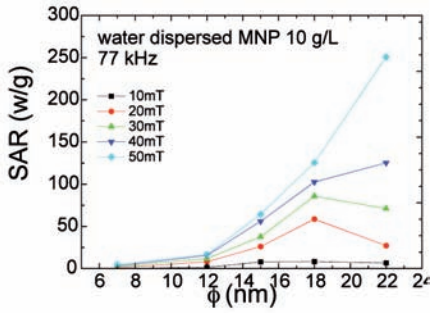
NANOvsCSC

"Optimisation of functional NANOparticles as a novel, minimal-invasive and efficient therapy for targeting Cancer Stem Cell"

Funding: Spanish Ministry of Science and Innovation (Fundamental Research Programme). MAT2010-21822-C02-01.
Duration: 2011-2012
Principal Investigator: Dr. Francisco Terán

The aim of the project is to investigate the dynamical magnetic properties of ferrite magnetic nanoparticles (MNP) for their therapeutic use –based on magnetic heating– against cancer cells. The MNP magnetic heating capability is currently being clinically tested as a novel treatment modality for solid cancers with promising early results. The MNP heating capabilities originate from a hysteretic non-reversible magnetic behaviour expected at dynamic regime. However, systematic studies of the dynamical MNP magnetic properties to identify the onset of hysteresis of MNP and to characterise their dynamically-induced heating capabilities are still lacking. This project has evaluated the dynamical magnetic properties and heating power in magnemite MNP as a function of size and AC magnetic field sweeping rate. Thus, the project has allowed to improve the chemical reaction conditions for synthesizing magnetite nanopartibles by thermal decomposition in organic media with optimal magnetic and magneto-thermal properties.



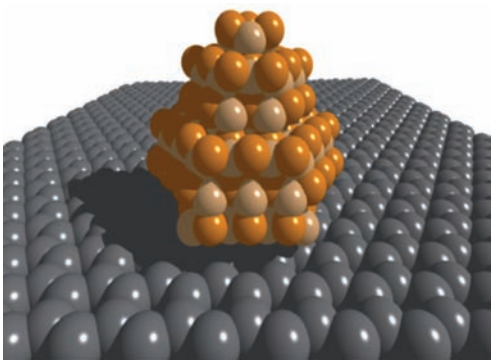


Left: TEM micrographs from 15 nm size MNP. Notice the high size uniformity.
Right. SAR values of SPION measured in water dispersion at iron concentration of 10mg/ml for different sizes and magnetic field amplitudes ranging from 0 to 50 mT at a given frequency (77 kHz).

DOTSCAN

"Growth and characterization of new nanomaterials based on self-assembled quantum dots and carbon nanotubes on solid surfaces"

Funding: Spanish Ministry of Science and Innovation (Fundamental Research Programme). MAT2009-13488
Duration: 2010-2012
Principal Investigators: Dr. Beatriz Hernández and Dr. Roberto Otero



The performance of devices based on semiconductor nanocrystals (NCs) improves both with stronger interface interactions among NCs and between NCs and solid electrode surfaces. MAT2009-1348 focused on the synthesis and characterization of NCs on flat graphitic surfaces by surface science techniques. In particular, the combination of X-ray photoelectron spectroscopy (XPS) and solid ^{31}P CP/MAS NMR (cross-polarization/magic angle spinning nuclear magnetic resonance) shows that the selective substitution of long organic chains by chlorine atomic ligands during the colloidal synthesis promotes the adsorption of CdSe NCs to carbon sp^2 surfaces, leading to the formation of well-ordered NC monolayers on graphitic materials. The degree of order was compared with those obtained using other methodologies such as Langmuir-Blodgett, spin coating, the vertical deposition method or by electrospray in ultra high vacuum. This comparison shows valuable information about the interaction taking place between nanoparticles and graphitic surfaces.

NANOBIOMAGNET

"Fundamentals and applications of molecules, magnetic nanoparticles and nanostructures: from spintronics to biomedicine"

Funding: Programas de Actividades de I+D entre grupos de investigación de la Comunidad de Madrid. *S2009/MAT-1726*
Duration: 2010-2013
Principal Investigator: Dr. Rodolfo Miranda
www.nanobiomagnet.es

NANOBIOMAGNET is a research project entitled "Fundamentals and Applications of molecules, magnetic nanoparticles and nanostructures: from spintronics to biomedicine". The project is framed in the R & D activities program of the Community of Madrid, co-financed by the European Social Fund, whose development takes place between 2010 and 2014.

NANOBIOMAGNET involves eleven research groups from public research institutions and two laboratories of the Laboratory Network of the Community of Madrid (REDLAB) and is coordinated by Professor Rodolfo Miranda. NANOBIOMAGNET comprises various facets of work on nanostructures, molecules and magnetic nanoparticles.

Some of the activities explored in NANOBIOMAGNET are: using ordered sets of magnetic spots as high density information storage media, using magnetic nanoparticles in treatment of tumors by hyperthermia and the formation of ordered structures of nanowires for screening or developing protective coatings against electromagnetic radiation.

MADRISOLAR2

"Photo-and Electroactive materials for organic and hybrid solar cells"

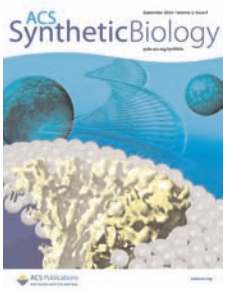
Funding: Programas de Actividades de I+D entre grupos de investigación de la Comunidad de Madrid. *S2009/MAT-1726*
Duration: 2010-2013
Principal Investigator: Dr. Nazario Martín

The aim of this Project is focused on the design, development and optimization of new and suitable Materials for light harvesting and their further application in the preparation of photovoltaic devices. This ambitious objective requires a multidisciplinary effort ranging from the chemical synthesis to produce functional materials to the understanding of the physical phenomena responsible for the photovoltaic response of the devices.

Thus, in this context, the main tasks will be the synthesis of new photo- and electroactive compounds with: i) a control on their HOMO-LUMO energy levels, ii) a better absorption in the visible and near infrared, iii) a better charge mobility (electrons and holes), iv) a better control on the morphology at the nanometer scale and, v) possibility of geometrical and electronic design through theoretical calculations. The aforementioned goals should lead to a more competitive photovoltaic technology in our country.

NOBIMAT-M

"New materials and hybrid biofunctional devices in Nanoscience"



Funding: Programas de Actividades de I+D entre grupos de investigación de la Comunidad de Madrid. S2009 / MAT-1507.
Duration: 2010-2013
Principal Investigator: Dr. J.López Carrascosa

This Program is aimed to study new materials and hybrid bio-functional tools in Nanoscience. It is composed by nine research groups covering molecular and cellular biology, biophysics, chemistry and nanotechnology, from IMDEA Nanoscience, CSIC, Autonomous University and Complutense University of Madrid. The objectives of the program includes the preparation, characterization and engineering of biological functional modules, the manipulation of biological complexes at the single molecule level, the modification of lipid surfaces to integrate biological complexes, the generation of lipoprotein nanoparticles for drug delivery, and the generation of ultra-sensitive tools for detection of biological molecules.

The Program has resulted up to date in 8 PhD theses, and more than 60 publications in JCI Journals.

NANOMADRID

Know Science Today Opens the Future's Doors

Funding: FEYCIT
Duration: 2012-2013
www.nanomadrid.es

The aim of this project is to promote the transfer of scientific knowledge to the society. Particularly, we aim to engage high school students with science, since we believe that the current students are the future of the Spanish science. We plan to achieve our goals through dynamic workshops at the schools and high schools, where students can

have a direct contact with current science. Our team is composed by several professors and researchers from different institutions around Madrid, which are participating in several events for the promotion of science at schools. We have prepared a website where the people interested can contact us to prepare a specific workshop at their schools.

PERIGEO

Investigación En Tecnología Espacial Sobre Plataforma UAV Deimos Space, S.L.U

Funding: Ministerio de Ciencia e Innovación. Programa INNPRONTA. With AERNNOVA ENGINEERING SOLUTIONS IBERICA S.A.
Duration: 2012-2015

PERIGEO is the name of a research project that will look into ways for optimizing the design and engineering of UAVs for space use. It is one of seven projects funded by the Centre for Industrial Technological Development (CDTI) INNPRONTA program, which is meant to promote stable cooperation in R&D between public and private entities in areas of strategic importance for the development of the national economy. In this first call, INNPRONTA received a total of 42 proposals and PERIGEO was one of the seven selected.

The project is endowed with a budget of over 18 million euros and funding of 85%. As part of the project, a cluster of laboratories will be started up, constituting an integrated framework for research and design. The consortium consists of 8 private companies and 7 public research organizations.

The project will serve as a driving force for the development of Spanish space technology, within the framework of the Space Technology Plan established by the Spanish.

3.5. Fellowships and internships

3.5.1. Fellowship

7FP Marie Curie Action. AMAROUT

Incoming Fellowships

Call 2012
Dr. Damien Joly (until September 2012), Dr. Cristina Flors, Dr. Pawel Nita, Dr. Marta Mroz, Dr. Koen Lauwaet

Call 2011
Dr. Fabián Calleja, Dr. Miguel Angel Niño, Dr. Aránzazu Aguirre (until July 2012), Dr. Shinto Varghese

Call 2010
Dr. Enrico Gnecco, Dr. Feng Luo

Call 2009
Dr. Paolo Perna, Dr. Larry Luer

Reintegration Fellowships

Call 2009
Dr. Aitziber Lopez-Cortajarena

Spanish Ministry of Science and Innovation

Ramon y Cajal Programme

Call 2011
Dr. Francisco Terán; Dr. Cristina Flors; Dr. Begoña Sot

Call 2009
Dr. Larry Luer, Dr. Juan Cabanillas

Call 2008
Dr. Emilio Pérez, Dr. Juan Luis Delgado, Dr.Teresa González

Call 2007
Dr. Johannes Giershner, Dr. Ricardo Arias, Dr. Alberto Bollero, Dr. Beatriz Hernández (until September 2012)

Juan de la Cierva Programme

Call 2011
Dr. Paolo Perna

Call 2010
Dr. Fulvio Brunetti (until January 2012)

Technical Support Specialist Programme

Call 2011
Dr. Santiago Casado

Spanish Ministry of Education

FPU Programme. Predoctoral Grant

Call 2011
Macarena Calero

Chinese Scholarship Council

Call 2011
Longfei Wu. "Organic position sensitive photodetectors". Four years PhD fellowship
Hauyu Feng. "*Multilevel magnetic recording in bit patterned media for areal densities above 5 Terabit-per-square-inch"* Four years PhD fellowship

XXII Becas de Investigación Caja Segovia

Dr. Gorka Salas. "Study for the removal of arsenic and nitrates, through nanotechnology, in water supplies from towns of Segovia"

fellowship

3.5.2. Internships

Alberto de Juan

Mechanically Interlocked Carbon Nanotubes Universidad Complutense de Madrid. Spain

Francisco Javier Pedrosa

Isothermal Exchnage bias-like effects in perpendicularly coupled ferromagnetic bilayers. Universidad de Cádiz. Spain

Carlos Pimentel

Nanomanipulation of dolomite type calcite islands on dolimite-type [104] surfaces in aqueous solution and Universidad Complutense de Madrid. Spain

Romina Andrea Lorca

Functionalization of surfaces with SWCNT and DNA. Universidad de Santiago de Chile. Chile

Mohammadreza Azani

Graphene production by sonication of graphite Universidad Autónoma de Madrid

Sara Hernández

*Study of Proteins Self-Assembly towards the generation of Novel Biomaterials.*Universidad del Pais Vasco. Spain

Stefano Gambera

Single Molecule Characterization of the translocation mechanism of a molecular motor involved in DNA replication. Universidad Magna Grecia de Catanzaro, Italy

Irene Gutiérrez

The Elasctic Response of the DNA-RNA Hybrid Polymer Universidad Autónoma de Madrid. Spain

Azin Hassapour

*Surface Characterization of Graphene Generated by Chemical Exfoliation of Graphite***.** Universidad Autónoma de Madrid. Spain

3.6. Institutional activities

18/06/2012
Host Institution and co-organizer of the visit of the Science & Technology Commission of Shanghai Municipality (STCSM)

18/09/2012
Host Institution of the Info day "2012 Starting & Consolidators Grants Call"
http://www.oficinaeuropea.es/programa-marco

27-28/09/2012
EU-China Graphene Scientific Summit, Beijing China
"Promoting Sino-European Cooperation on Graphene Applications"
- European Leader: IMDEA Nanoscience
- China leader: Institute for Nanoscience and Technology UPK
- UE Diplomatic Delegation in China

28/09/2012
Participation in the "**La Noche de los Investigadores". La Ciencia es mi Vida**
http://www.madrimasd.org/noticias/la-noche-de-los-investigadores-de-septiembre-de-la-ciencia-es-mi-vida/54103

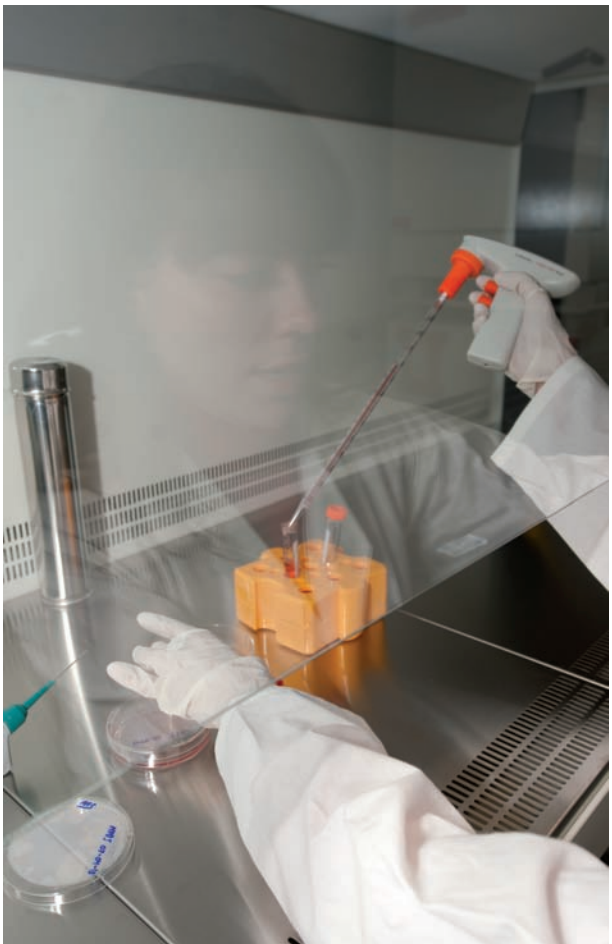
7/11/2012
Participation in the "XII Semana de la Ciencia"
http://www.madrimasd.org/semanaciencia/2012/

Join the Chinese Scholarship Council
http://www.csc.edu.cn/

Member of the Graphene Flagship
http://www.graphene-flagship.eu/GF/index.php

Member of the Network of Research Laboratories of Comunidad de Madrid (REDLAB)
http://www.madrimasd.org/Laboratorios

institutional activities



academic activities

3.7. academic activities

3.7.1. Theses

15/10/2012

"Grafeno epitaxial en metales de transicion: estudio mediante microscopia y espectroscopia de efecto tunel"

Student: Sara Barja Universidad Autónoma de Madrid

Advisors: Dr. Amadeo L. Vázquez de Parga

3.7.2. Courses

Participation in

- Interuniversity Master's Degree in Molecular Nanoscience and Nanotechnology[2]
- Interuniversity Master's Degree in Condensed Matter Physics and Nanotechnology[3]
- Master's Degree in Biophysics[4]
- Doctoral Program in Protein Structure and Function[5]
- Doctoral Program in Molecular and Cell Biology[6]

[2] Organized by the Universities of Alicante, Valencia, Valladolidy Autónoma de Madrid, in Spain

[3] Organized by the Universities Autónoma de Madrid, Oviedo and Murcia, in Spain

[4] Organized by the Universidad Autónoma de Madrid,Spain

[5] Organized by the Universities of Zaragoza, Sevilla, Autónoma de Barcelona and the Consejo Superior de InvestigacionesCientíficas (CSIC), in Spain

[6] Organized by the Universidad Autónoma de Madrid, Spain

seminars

3.8. External Seminars at IMDEA Nanociencia

13/04/2012

"Design and formulation of siRNAs for anti-inflammatory therapy in a colitis mice model"

Dr. Sandra Milena Ocampo Departamento Ciencias Fisiologicas II Facultad de Medicina Universidad de Barcelona L'Hospitalet de Llobregat

26/04/20121

"A Chemist Approach to Order in Molecular Semiconductors"

Prof. Yves Henri Geerts Université Libre de Bruxelles (ULB), Faculté des Sciences, Laboratoire de Chimie des Polymères CP 206/1, Bd du Triomphe, 1050 Brussels, Belgium

11/05/2012

"AFM Technologies in Life sciences"

Prof. Dr. Christoph Gerber Director of scientific communication Swiss Nanoscience Institute NCCR National Center of Competence for Nanoscience Institute of Physics, Univ. of Basel, Basel, Switzerland

23/07/2012

"Control and Dynamics of Porous Self-Assembled Monolayer Formed at Liquid-Solid Interfaces"

Prof. Yoshito Tobe Graduate School of Engineering Science, Osaka University

10/09/2012

"Methods for the Chemical Synthesis of Fullerenes and Carbon Nanotubes"

Prof. Lawrence T. Scott, Louise & Jim Vanderslice Professor of Chemistry Merkert Chemistry Center, Boston College Chestnut Hill, MA 02467-3860

05/11/2012

"Molecular Spintronics"

Prof. E. Coronado, Instituto de Ciencia Molecular (ICMol). Universidad de Valencia (Spain)

21/11/2012

"Cell Stimulation by polymer photoexcitation"

Prof. Guglielmo Lanzani Director of Center for Nano Science and Technology @ POLIMI Istituto Italiano di Tecnologia (IIT) Milan, Italy

3.9. Honors

honors

Prof. Fernando Martín

ERC Advanced Grant support for research with the project *X-CHEM*.

Dr. Emilio Pérez

ERC Starting Research Grant support for research with the project *MINT*

Prof. Nazario Martín

ERC Advanced Grant support for research with the project *QUIRALLCARBON*

Dr. J. Ricardo Arias González

Real Sociedad Española de Física and the Fundación BBVA award for the best article published in "Revista Española de Física and Revista Iberoamericana de Física"

Prof. Nazario Martín León

Rey Jaime I 2012 Award on Basic Research. Alexander von Humboldt and Richard Smalley Awards 2012. Gold medal and research award 2012 (Spanish Royal Society of Chemistry). Doctor Honoris Causa. University of Havana (Cuba)

Dr. Begoña Milian-Medina

President of the Young Chemist's Group of the Spanish Royal Society of Chemistry (RSEQ) 26.10.2011.

Prof. José L. Carrascosa

Appointment as Honorary Member of the Portuguese Society of Microscopy (2012).

3.10. Scientific outreaching activities

3.10.1. Talks

23/01/20121

G. Hernandez-Salas "Nanopartículas de óxido de hierro. Nanotecnología contra el cáncer." at IES Alfonso IX, Zamora, Spain.

03-10/02/2012

XIII Escuela Nacional de Materiales Moleculares, El Escorial, Spain.

- "Synthetic Molecular Machines" E. Pérez
- "Fullerenos y otras nanoformas de carbono" and "Células Fotovoltaicas Orgánicas e Híbridas" Nazario Martín
- "Células fotovoltaicas orgánicas e Híbridas" JL Delgado
- "Phthalocyanines as Molecular Materials" Tomas Torres

12/03/2012

JL Carrascosa "La formación de un contenedor proteico a escala nanoscópica: El ejemplo de los virus." Instituto de Nanociencia de Aragón. Zaragoza, Spain

23/03/20121

JL Carrascosa "Building a viral particle: The morphogenetic pathway". Instituto de Ciencia de Materiales de Madrid. Madrid, Spain

28/03/2012

G. Hernandez-Salas "Synthesis of magnetic nanoparticles in organic media" ICMM internal workshop: Magnetic Nanoparticles and Patterned Structures. Madrid. Spain

05/ 07/2012

B. Ibarra "Polymerases involved in DNA replication, repair, and mutagenesis. From basic knowledge to biotechnological applications". CBSO-CSIC, Madrid, Spain

09-13/07/2012

Nazario Martín "Supramolecular Chemistry of Carbon Nanostructures: Concave-convex Interactions". La Llum com a font d´energia: del laboratori al món industrial, Tarragona, Spain

9-13/09/2012

A. Bollero "NANOPYME: case of successful proposal to EU FP7-NMP.2012 Call" (CDTI), Madrid, Spain

11/10/20121

Ricardo Arias **"**DNA polymerase: a Maxwell's demon that replicates genetic information**"**. Instituto de Ciencia de Materiales de Madrid (CSIC). Madrid. Spain.

17/10/2012

B. Ibarra "Nanomotores Biológicos y Pinzas Opticas". Master in Biophysics, Universidad Autónoma de Madrid, Spain

27-31/10/2012

V European School on Molecular Nanoscience, Cuenca, Spain.

Specialized lectures

- "Magnetic Nanoparticles for cancer treatment" Francisco Terán
- "Magnetism in molecules absorbed on grapheme" Rodolfo Miranda

13/11/2012

M. T. González 'La atmósfera y los estados de la materia' Colegio Humanitas, Tres Cantos,Spain

28-10 02-11/2012

J. Ricardo Arias **"**Life in the nanoscale: a paradigm of Feynman machinery**"**. Summer School: 5th European School on Molecular Nanoscience (ESMolNa) Cuenca, Spain.

11/12/20121

J. Ricardo Arias "Life in the nanoscale "Hablemos de Física", Lectures on novel topics in physics for undergraduates organized by Universidad Complutense de Madrid. Spain

3.11. Other outreaching activities

17/01/2012

La nanociencia, una inversión con mucho futuro. Rodolfo Miranda

Published in *El Mundo*

http://www.elmundo.es/elmundo/2012/01/16/nanotecnologia/1326728935.html

31/01/2012

Nuevas herramientas para la 'nanobioingeniería' J. L. Carrascosa

Published in *El Mundo*

http://www.elmundo.es/elmundo/2012/01/31/nanotecnologia/1328009225.html

21/05/2012

Manipulando nano-motores biológicos individuales Borja Ibarra

http://www.madrimasd.org/informacionidi/noticias/noticia.asp?id=52655&origen=notiweb_suplemento&dia_suplemento=lunes&seccion=noticias

29/08/2012

Talking, doing science and governing, J. Ricardo Arias

Tribuna in Sociedad-Ciencia. Published in *El País*

http://sociedad.elpais.com/sociedad/2012/08/29/actualidad/1346261358_628429.html

03/12/2012

Nanociencia y tecnología producen imanes permanentes de última generación. Alberto Bollero

http://www.madrimasd.org/informacionidi/noticias/noticia.asp?id=55041

research focus

annual report 2012

nanopyme

nanocrystalline permanent magnets based on hybrid metal-ferrites

Nanopyme is partially funded by the European Community through the Seventh Framework Programme (FP7) under grant agreement no. 310516

duration

december 2012-2015

funding scheme

collaborative – SMALL scale focused research project

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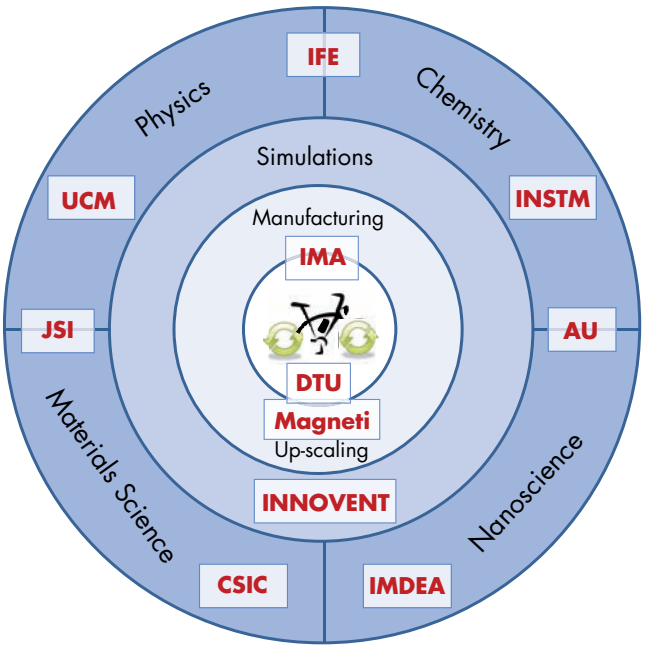
SEVENTH FRAMEWORK PROGRAMME

EUROPEAN UNION

overview

NANOPYME addresses the design and development of high quality nanocrystalline **permanent magnets without rare-earths.** Rare-earth elements show important problems from a strategic as well as from an environmental point of view with fundamental economical and social implications at a worldwide scale. Despite of it, permanent magnets with top magnetic performance used in most of nowadays technological applications contain rare-earth elements as fundamental constituents. Permanent magnets are essential e.g. in transport, wind energy, refrigeration and information technology applications. It is not possible to consider the reduction of permanent magnets as they are **key elements of our technology. NANOPYME** aims to develop **nanocrystalline ferrites-based magnets** to compete with rare-earth magnets in a large portion of the above mentioned applications where the latter are simply used because standard ferrites do not fulfill the magnetic energy product required.

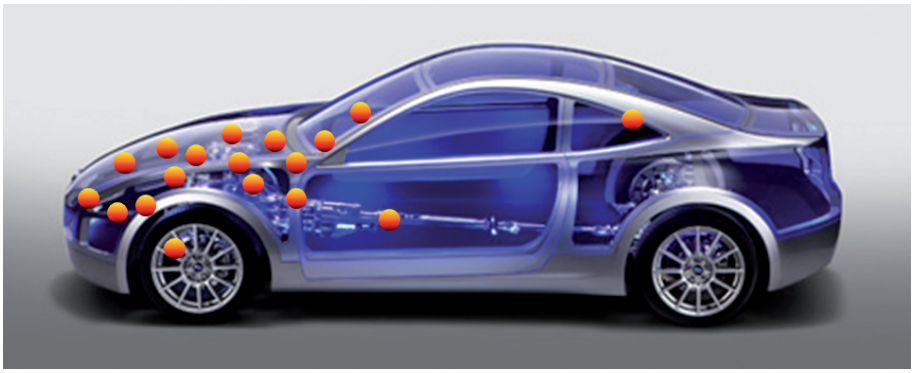
NANOPYME groups 4 public research institutes, 4 academia centres and 3 industrial partners from 6 different countries to create a multidisciplinary frame combining the acquired knowledge in **nanoscience** and advanced production technologies. The development of the new magnets in **NANOPYME** will contribute to revert the situation of the permanent markets from the nowadays situation which is determined by the geographical distribution of the raw materials to a new market where the know-how and technological development will determine the market leader.



permanent magnets in nowadays applications

A magnet can be considered as an energy-storage device which provides a magnetic field in a particular volume of space. One might wonder about the application of permanent magnets and their **importance in nowadays applications.** A car contains more than 400 permanent magnets, a common refrigerator contains about 70 permanent magnets and the generators used in latest wind turbines require up to 2 tons of these magnets.

This is an important topic from a social as well as an economical point of view. The **worldwide market** of permanent magnets moved about $ 9 billion in 2011 and it is expected to achieve $ 14 billion in 2020.



problematic of rare-earth elements

Rare-earth magnets are required for high performing applications or micro-scalable devices of high technological impact due to their performance to size ratio. Worldwide industries depend critically on the production of such type of magnets. This is a **major problem for E.U.** as most of the mines and reserves of rare-earths are controlled by emerging countries (mainly China with 97% of the rare-earth natural resources) that started recently to develop their own technological devices instead of simply exporting the raw materials. Consequently, rare-earths represent the **group with the highest supply risk.** Moreover E.U. companies do not produce rare-earth magnets.

In addition a **serious environmental impact** of rare-earths mining should not be neglected. Rare-earths mining makes useless the fields and all the surroundings due to the resulting acidic wastewater and radioactive residues generated in the refinement process.

Therefore, the development of permanent magnets without or with reduced amounts of rare-earths, but showing comparable performance, is crucial in order to allow E.U. technological companies to be **competitive in the global market** and, additionally, to reduce significantly the environmental impact of the permanent magnets sector development.

our approach

NANOPYME makes use of two complementary approaches for the production of rare earth-free permanent magnets. The first one is based on the possibility of achieving improved magnetic properties for ferrites different from those of bulk or microcrystalline materials by going to the **nanometer scale**. The achievements done will be translated to the synthesis of **novel hybrid nanocomposites** based on metals and ferrites in order to combine the complementary magnetic properties of both materials types. Our approach proposes to take advantage of the recent advances in **nanoscience** to be used in the design of these new permanent magnets. In view of practical applications, an improved magnetic performance of these newly designed rare earth-free permanent magnets will guarantee their use in some nowadays applications which are currently covered by more expensive low energy-range rare-earth permanent magnets.

objectives

- Development of a **new generation** of rare earth-free permanent magnets.
- Successful **scaling** from the laboratory to the mass production under considerations of:
  - Competitiveness
  - Safety
  - Recyclability
  - Eco-efficient production
- Proof of functionality:
  Construction of a **prototype** electric motor integrating **NANOPYME** magnets.

pocaontas

Polymer-Carbon Nanotubes Active Systems for Photovoltaics

Pocaontas is funded by the European Community through the Seventh Framework Programme (FP7) under grant agreement no. 316633

duration

November 2012-2016

funding scheme

Marie Curie Actions-Initial Training Networks (ITN)

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POCAONTAS

SEVENTH FRAMEWORK PROGRAMME

MARIE CURIE ACTIONS

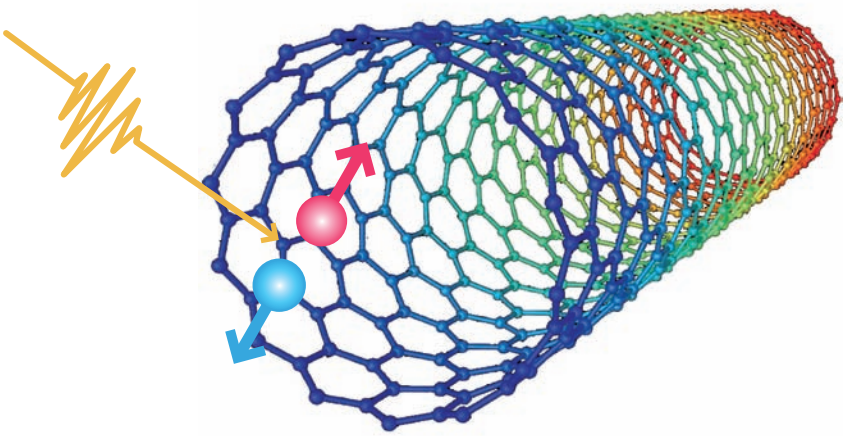
Polymer-Carbon Nanotubes Active Systems for Photovoltaics (POCAONTAS) is a training network coordinated by IMDEA Nanoscience that brings together top European players in the field of Organic Solar Cells (OSC) offering a unique opportunity for research career development. POCAONTAS will train a total of 14 researchers in the development of highly efficient and stable OSC based on tailored blends of polymers with single wall carbon nanotubes (SWNT) that are well suited for OSC due to their inherent extremely high stability, high carrier mobility and tenability of optical gaps.

"Classical" silicon based solar cells are now a mature technology, which means that further market potentials in this area can no longer be expected by innovation, but only by cutting costs. Moreover, silicon solar cells have limitations that render them unpractical for a significant number of applications and markets:

- Their **energy payback time** {link to frequently asked question 1} is so long that they are only economical under ideal irradiation conditions. In the private consumer market in Europe, irradiation conditions are far from ideal, so that their use would require subsidizing them by governmental measures. This however finds no longer the agreement of European voters.

- Silicon based solar cells require **vertical incidence** of the incoming light, which is not the case if the solar cells are supposed to be included into a façade or a window.

- Silicon based solar modules are **heavy, opaque, and cannot be used as design components**. Design is however one of the most important properties of any successful product on the market.



A novel alternative to silicon based solar cells are “Organic solar cells”, where “organic” means that their active materials are carbon based, like organic matter. Organic solar cells are flexible, thin, lightweight and pleasantly colored, so they integrate easily into building structures like, facades and windows.

However, before organic solar cells can enter mass production, their efficiency and long term stability must substantially be enhanced. This is where POCAONTAS come in. POCAONTAS partners have a unique expertise in the field of SWNT chirality selection and aggregation control, in polymer science and formulation of OSC, and in OSC device technology, stability and commercialization.

As a first step, POCAONTAS would address the study of the interface between Carbon nanotubes and organic polymers on a molecular scale.. The second step would be then to learn to control the nanoscale alignment of polymers and Carbon nanotubes inside working photovoltaic devices. Here again, the capacities of the consortium, comprising internationally renowned nanoscience research centers, makes the difference, bringing the prospective for both career training of the fellows and the research output to the maximum possible level.

editor
imdea nanoscience institute

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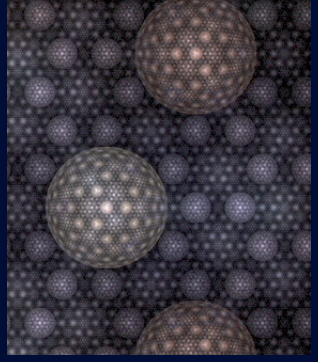

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annual report