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foreword

Rodolfo Miranda
Director, IMDEA Nanoscience Institute
april 2011

word

The Institute, during 2011, has continued recruiting scientists of talent, organizing new labs, training young scientists, attracting external support and developing projects with strategic partners. These efforts have been recognized with awards to the best Thesis in Life Sciences, the best article in the journal of the RSEF and the presidency of the young chemist group in the RSEQ, among other distinctions.

The scientific production has been extraordinary, with almost 100 papers published in 2011 in many of the most prestigious journals (average impact factor: 6.405, among the highest in Spanish scientific institutions). The Institute starts to appear in the international panorama. Articles by IMDEA Nanociencia have received more than 2000 citations from other authors and the Institutional h index is 22, an amazing achievement for an institution with such a brief existence.

The development of a new model of knowledge transfer, based on a medium-term, strategic partnership with companies to include their future needs into the developing research programmes, is producing its first results. Examples related to aeronautics and pharmaceutical areas are already under way and important EU projects with strong participation from industries are coordinated by IMDEA Nanociencia researchers.

In 2011 we have achieved a much-awaited milestone for IMDEA Nanociencia: the completion of the construction of the building of the Institute. This crucial step would allow us to move to the building in the next year and start a brand new time for the Institute, a time to fully develop its potentialities.

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 relentless support.

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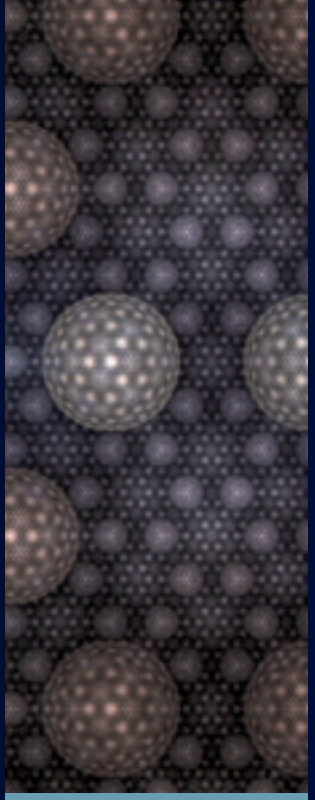
1 overview



1.1. Legal Status

IMDEA Nanociencia is a private Foundation created by a joint initiative of the regional Government of Madrid (CM) and the Ministry of Science and Education, now Science and Innovation (MICIIN), of the Government of Spain.

The Foundation manages the Madrid Institute for Advanced Studies in Nanoscience, a new interdisciplinary research centre dedicated to the exploration of basic nanoscience and the applications of nanotechnology in connection with innovative industries.

An agreement was signed in February 2007 by both institutions to share the financial support of the Foundation with a long term commitment.

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

1.2. Strategic Goals

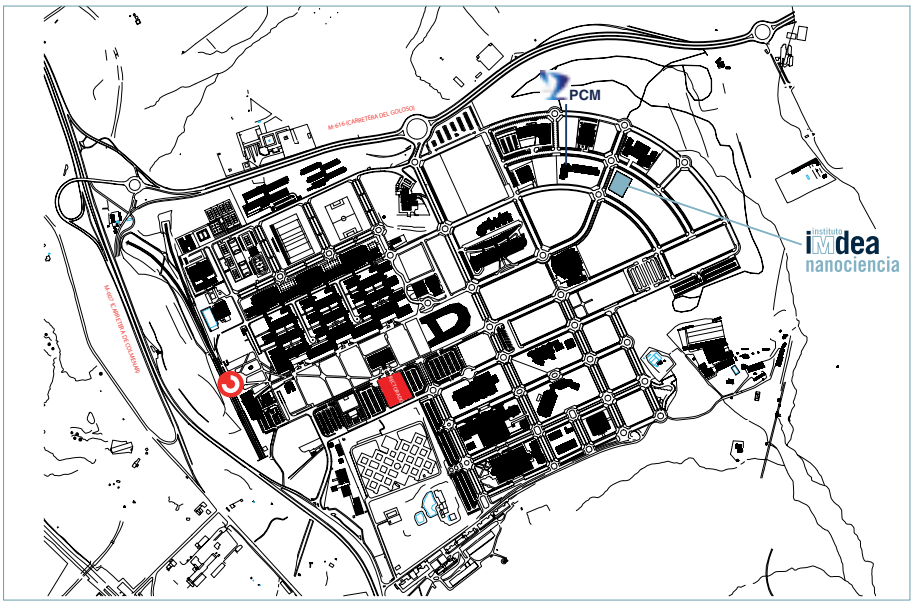
- Attract new talent to Madrid/Spain in areas related to nanoscience and nanotechnology to improve the competiveness.
- Carry out research of excellence.
- Develop a new model of transfer of knowledge to the private sector based on its incorporation to the definition (and financial support) of medium-term, specific research lines.

1.3. Location

IMDEA Nanociencia has been located provisionally mostly in spaces from the Faculty of Sciences of the UAM and the Faculty of Chemistry of the UCM. The building of IMDEA Nanociencia is located 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 various research areas will facilitate its success.

The foundation stone was laid on a public ceremony on January, 13th, 2010. The building has been completed by December 2011. It has 8.200 m^2 of space for labs, offices and facilities such as the Center for Nanofabrication of the Campus of International Excellence UAM+CSIC or the Center for Ultra-High Resolution Electron Microscopy.

The new building of IMDEA Nanoscience will host approximately 100 senior and post-doctoral 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. The building is expected to be fully operational in 2012.

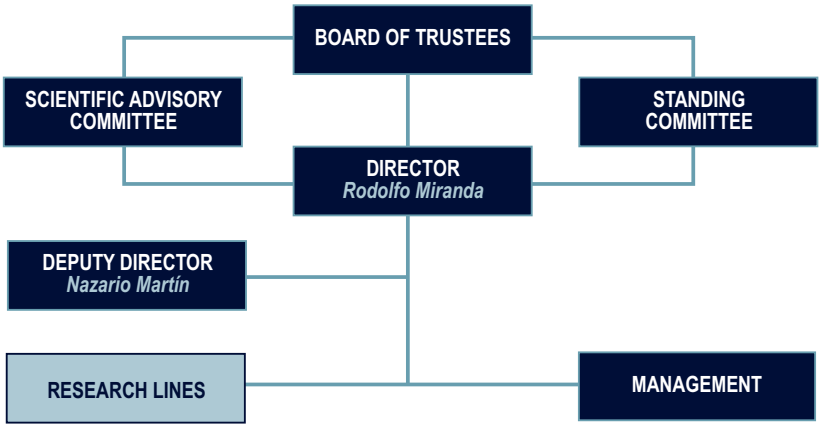


IMDEA Nanociencia. Universidad Autónoma de Madrid. Cantoblanco Campus.

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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1.7. Scientific Advisory Committee

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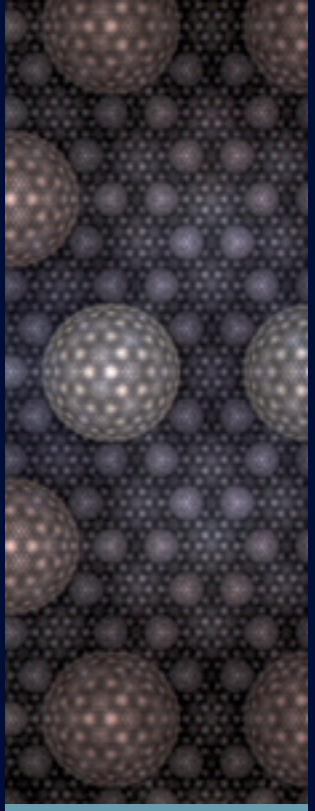
Director of Linz Institute for Organic Solar Cells (LIOS). Institute for Physical Chemistry Johannes Kepler University of Linz. Austria

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

2 research programmes and scientists



Following the recommendations of the Scientific Advisory Committee, which were approved by the Board of Trustees of IMDEA-Nanociencia on the meeting of December 2007, the Institute has started 6 Research Programmes plus a horizontal Programme on nanofabrication. They have been selected on the basis of their interest and the existing capabilities (and limitations) to achieve international impact.

Programme 1
Molecular Nanoscience

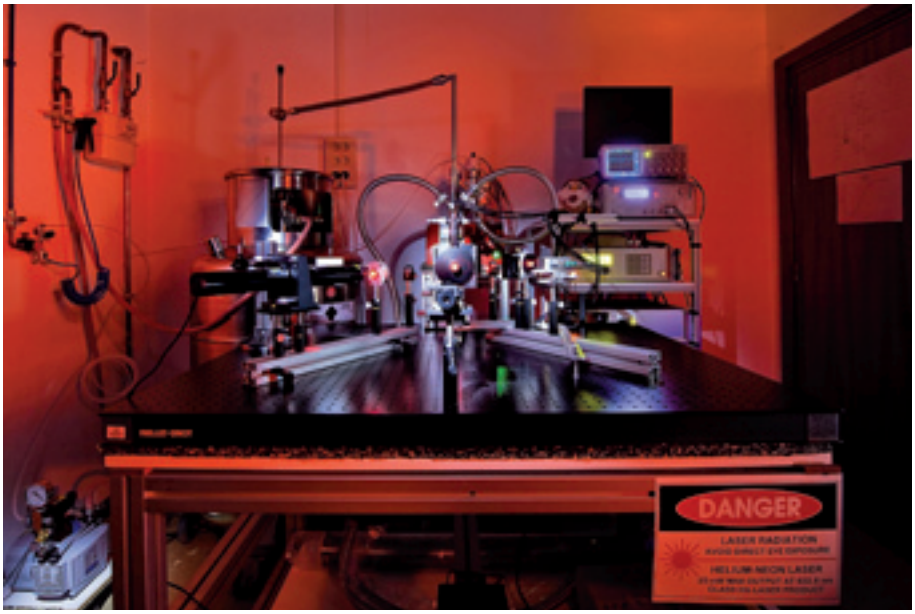
Programme 2
Scanning Probe Microscopies and Surfaces

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.

Prof. Nazario Martín

Programme Manager

Double Affiliation: Universidad Complutense de Msdrid, Spain

Nazario Martín 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). Professor Martín's research interests span a range of targets with emphasis on the molecular and supramolecular chemistry of carbon nanostructures such as fullerenes and carbon nanotubes, p-conjugated systems as molecular wires, and electroactive molecules, in the context of electron transfer processes, photovoltaic applications and nanoscience. He has published over 380 papers in peer reviewed journals, given over 200 lectures in scientific meetings and research institutions, and supervised 22 theses. He has co-edited six books related with carbon nanostructures and he has been invited as guest editor for seven 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 is currently 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) and *ChemSusChem* (Wiley-VCH). He is a member of the Royal Academy of Doctors of Spain as well as a fellow of The Royal Society of Chemistry. Since 2006, he is the President of the Spanish Royal Society of Chemistry and, more recently, he has been the recipient of the "Dupont Prize of Science" in 2007.

Relevant publications

- "Controlling the Transformation of Primary into Quaternary Structures: Towards Hierarchically Built-Up Twisted Fibers" Juan Luis López, *et col. Angew. Chem. Int. Ed.* 2010, **49**, 9876–9880
- "Charge-transfer-induced structural rearrangements at both sides of organic/metal interfaces" Tzu-Chun Tseng, *et col. Nature Chemistry* **2**, *374-379,* 2010
- "A New exTTF-Crown Ether Platform To Associate Fullerenes: Cooperative n-π and π-π Effects" Bruno Grimm, *et col. J. Am. Chem. Soc.* **132** (2010) 17387–17389

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, teacher and institute manager. In 2004 he moved to Mons (Belgium) with D. Beljonne & J. Cornil, including a 4-month stay with J.-L. Brédas at Georgia Tech. Since 2008 he is 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 60 peer-reviewed papers (1600 cites, h = 22).

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 optical and photophysical properties of conjugated organic materials for optoelectronic applications, which he investigates in solution, supramolecular nanostructured host-guest compounds, thin films, suspended nanoparticles and single crystals.

Relevant publications

- Multi-Stimuli Two-Color Luminescence Switching via Different Slip-Stacking of Highly Fluorescent Molecular Sheets Seong-Jun 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
- "Optical Bandgaps of π-Conjugated Organic Materials at the Polymer Limit: Experiment and Theory" J. Gierschner, *et col.* *Adv. Mater.* 2007, **19**, 173-191

Dr. Aránzazu Aguirre

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

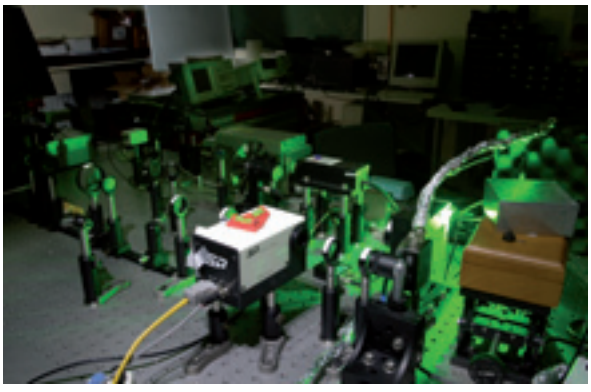
Larry Luer (born in Leutkirch / Germany in 1965) received his PhD at the University of Tübingen in 2001, studying the photoconductivity of organic conjugated molecules. In 2001/2002, he held a Marie Curie Individual fellowship at Politecnico di Milano in the group of Guglielmo Lanzani, investigating 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)



Hybrid systems based on semiconductor nanoparticles

Dr. Beatriz H. Juárez

Researcher

Ph.D.: Universidad Autónoma de Madrid, Spain

Previous Position: University of Hamburg. Germany

Beatriz Hernández is a researcher in the frame of 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

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

Dr. Emilio M. Pérez obtained his BSc and MSc from the Universidad de Salamanca. He joined the group of Prof. David A. Leigh at the University of Edinburgh, where he obtained his PhD in 2005. He then carried out postdoctoral studies within the group of Prof. Nazario Martín at Universidad Complutense de Madrid. In December 2008 he joined IMDEA Nanoscience. He has received the 2006 IUPAC Prize for Young Chemists, the 2009 RSEQ Prize for Novel Researchers and the 2010 UCM Foundation Prize for Science and Technology. His main research interests concern supramolecular chemistry and the self-assembly of functional materials.

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 as 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. David Canevet

Postdoc

CIMA Laboratory - University of Angers, France

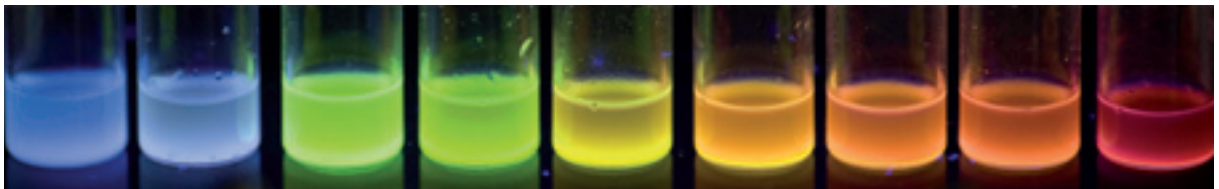
Dr. Fulvio Brunetti

Postdoc

University of California Santa Barbara, USA

Helena Isla

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

Postdoc

University of Rennes 1, France

Carmen Villegas

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

- "Photoinduced transient stark spectroscopy in organic semiconductors: a method for charge mobility determination in the picosecond regime", J. Cabanillas-González, *et col. Phys. Rev. Lett.* **96**, 106601, 1-4 (2006)
- "Exciton migration in beta-phase poly(9,9-dioctylfluorene)" M. Ariu, *et col. Phys. Rev.* B **67**, 195333, 1-11 (2003)
- "Energy transfer dynamics in polyfluorene-based polymer blends", A. R. Buckley, *et col*. *Chem. Phys. Lett.* **339** (2001) 331-336

Computational Design and Analysis of Novel p-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)

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 350 papers and 40 patents, given 180 lectures, and supervised 29 PhD. theses. He has an H-factor of 53. 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

- "Towards tunable graphene / phthalocyanine-PPV hybrid systems" Jenny Malig, *et col.* *Angew. Chem. Int. Ed.* 2011, **15**, 3561-3565
- "Triflate-Subphthalocyanines: Versatile, Reactive Intermediates for Axial Functionalization at the Boron Atom" J. Guilleme, *et col.* *Angew. Chem. Int. Ed.*, 2011, **15**, 3506-3509
- "Covalent and Non-Covalent Phthalocyanine-Carbon Nanostructure Systems: Synthesis, Photoinduced Electron Transfer, and Application to Molecular Photovoltaics" Giovanni Bottari, *et col.* *Chem. Rev.* 2010, **110**, 6768-6816, and papers cited therein

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 for almost 10 years at the University of Basel before moving to IMDEA Nanociencia. Among other topics, he investigated the frictional response of crystal surfaces in UHV, the onset of abrasion wear on the atomic scale, 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. Enrico Gnecco coauthored about 60 peer-reviewed articles (h-index 14) and several book chapters.

Research lines

At IMDEA Nanociencia Prof. Gnecco is responsible for research on nanotribology, i.e. the study of friction, adhesion and wear processes on the nanometer scale. His approach to this topic is both experimental (atomic force microscopy and related techniques) and theoretical (analytical models based on classical mechanics and reaction rate theory).

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)

Spin-Polarized STM

Dr. Fabián Calleja

Researcher
Ph.D.: Universidad Autónoma de Madrid, Spain
Previous Position: École Polytechnique Fédérale de Lausanne (EPFL), Switzerland

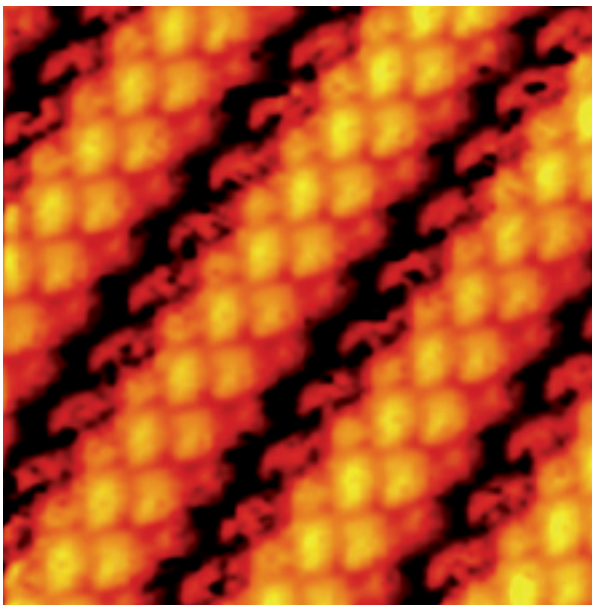
Fabian Calleja got his Ph. D. from the Universidad Autónoma of Madrid (UAM) in October 2007 with a work on the development of variable temperature STM. After his PhD, Dr. Calleja worked as a post-doctoral researcher in the group of Prof. Harald Brune in the Laboratory of Nanostructures at Surfaces (LNS) 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)



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

Juan Manuel Benayas

Technician

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)

Manuela Garnica

Ph. D. student

Sara Barja

Ph. D. student

Amjad Al Taleb

Ph. D. Student

Carmen Palacios

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

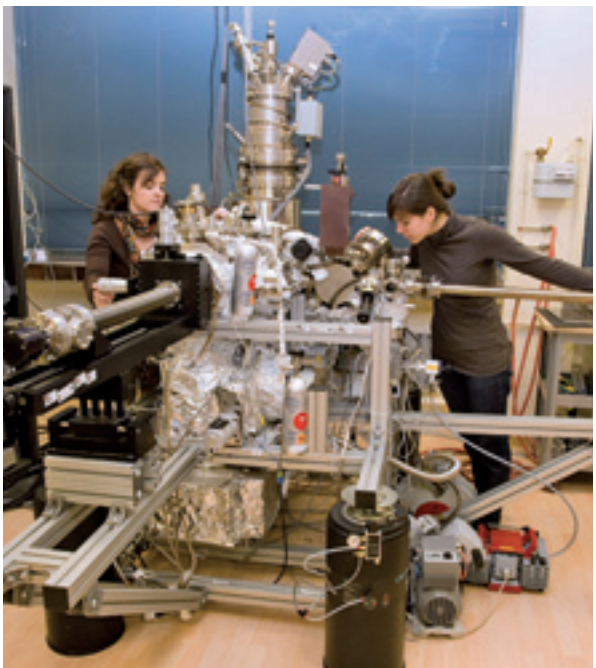
- Attophysics: Control of electron dynamics with ultrashort pulses and free electron lasers.
- Surface science: Molecular self-assembly and reactivity on metal surfaces and graphene.
- Nanoscience: Structure and properties of fullerenes and nanoparticles.

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)

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 a Ramón & Cajal Associate Professor at Universidad Autónoma de Madrid and, since 2008, 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)

Christian Urban

Ph. D. student

Fabiola Iacono

Ph. D. student

Jonathan Rodríguez

Ph. D. student

Physics of surfaces and thin films

Prof. José Maria 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

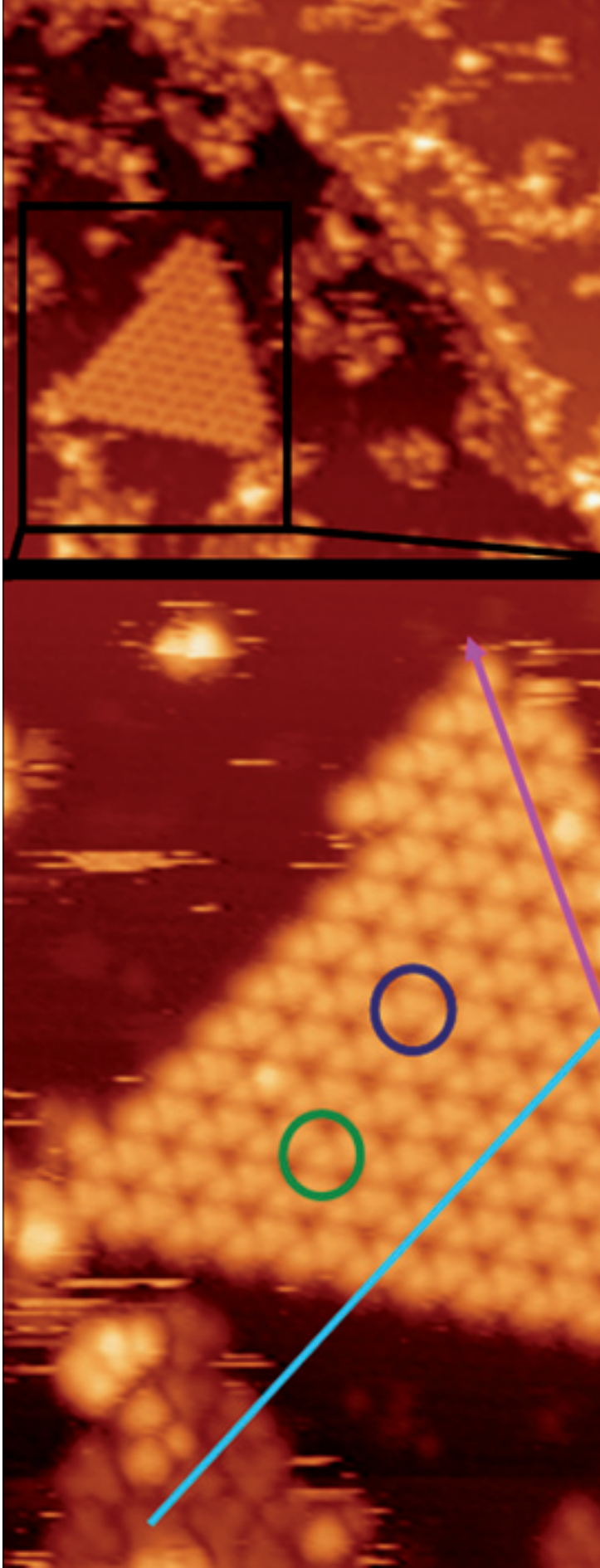
His research interest is centered on the physics of surfaces and thin films, in particular in scanning tunneling microscopy and electron spectroscopy studies of epitaxial growth, in ultrahigh vacuum conditions, of both organic and inorganic materials on solid surfaces.

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

Flavio Pendolini
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

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

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 semi-magnetic 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 35 communications at international congresses.

Research lines

- Thermal and magnetic response of superparamagnetic nanoparticles under dynamical regime Magnetic and spin dependent phenomena in nanostructures
- Stimuli responsive polymeric surfaces
- Quantum Hall effect and related phenomena
- Spin dynamics in semimagnetic semiconductor nanostructures
- Optical properties of semiconductor nanostructures

Relevant Publications

- "Collective character of spin excitations in a system of Mn^{2+} ions coupled to a two-dimensional electron gas" F.J.Teran, *et col.* *Phys. Rev. Lett.* **91**, 077201, 1-4 (2003)
- "Dynamics of the localised spins interacting with two-dimensional elctron gas: Coexistence of mixed and pure modes" M.Vladimirova, *et col.* *Phys. Rev.* B **78**, 081305, 1-4 (R), (2008)
- "g-factor dependence of the evolution of magneto-optical spectra with density of the quasi-two dimensional electrons in CdMnTe/CdMgTe heterostructures" T.Wojtowicz, *et col.* *Phys. Rev.* B **59**, R10437 4 pp (1999)

Dr. Gorka Salas-Hernández

Postdoc
Laboratoire de Chimie Organométallique de Surface. Lyon, France

Cintia Casado

Research Assistant

Hélène Takacs

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

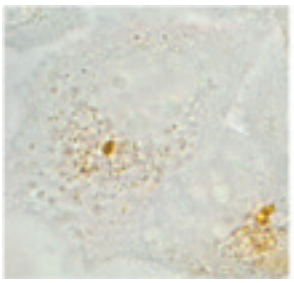
Dr. Ángeles Villanueva is a cell biologist. Her research is mainly focused on photodynamic therapy of cancer. In the last years, she has established new collaborations with research groups in the field of magnetic nanoparticles with applications in Medicine. She has studied in cell cultures: i) the mechanisms 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.

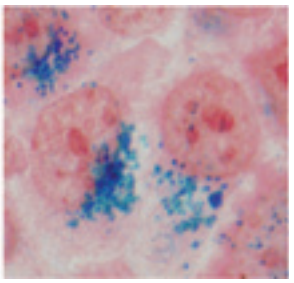
Research lines

- 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





programme 4
nanobiosystems: biomachines and manipulation of macromolecules

This programme includes several research lines which deal with the study of macromolecular complexes, their 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 AFM analysis of biological nanomachines, 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 behaviour of 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 Aggregates 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 with highly specialized functions and properties. Different groups of the Programme are collaborating with the Programme of Nanoacustics of the Institute for the study of organic surfaces as potential substrates for macromolecular ordered interaction, and the incorporation of macromolecules and biological assemblies into metal nano particles as transporters.

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.

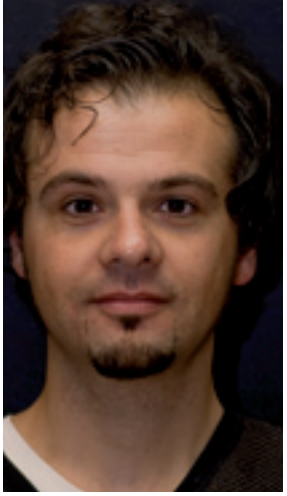
Research lines

- 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)

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

- "Plasmon-Exciton Interactions on Single Thermoresponsive Platforms" S. Hormeño, *et col. Nano Letters* **11**, 4742-4747 (2011).
- "Single-molecule spontaneous emission close to absorbing nanostructures" J.R. Arias-González, *et col. Appl. Phys. Lett.,* **85**, 3863-3865 (2004)
- "Single-molecule spontaneous emission close to absorbing nanostructures" M. Thomas, *et col. Applied Physics Letters* **85**, 3863-3865 (2004).

Silvia Hormeño

Ph.D. student

Adriana Martín de Aguilera

Ph.D. student

Paula Gregorio

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

Yolanda Garcimuñoz

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

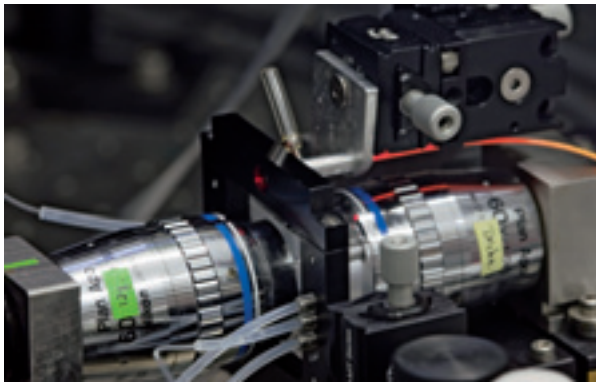
Many essential processes inside the cell involve mechanical tasks, which are carried out by specialized proteins called molecular motors. They are able to convert chemical energy into mechanical work at the molecular scale and therefore, present interesting biomedical and nanotechnological applications.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

Relevant publications

- Proofreading Dynamics of a Processive DNA Polymerase. Ibarra B., *et col. EMBO Journal* **28**, 2794-2802 (2009)
- Purification and functional characterization of p16, the ATPase of the bacteriophage Phi29 packaging machinery Ibarra B., *et col. Nucleic Acids Res.* **29**, 4264-4273 (2001)
- Topology of the components of the DNA packaging machinery in the phage Phi29 prohead Ibarra *B., et col. J. Mol. Biol.* **298**, 807-815 (2000)

José Alberto Morín

PhD student



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)

Dr. Santiago Casado

Postdoc
Universidad de Cantabria, Spain

Alvaro Alonso

Internship

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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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 from the University of Santiago de Compostela (Spain). Where she got a Ph. D. in 2003 with a work on melt-textured high-Tc superconductors that was awarded with the *Premio Extraordinario de Doctorado*. From 2004 to 2008 Dr. González has been Research Assistant at Basel University (Switzerland) with Professor Christian Schönenberger. 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, dealing with the electrical properties of single molecules using a scanning tunnelling microscope and exploring different techniques to contact an individual molecule, and study its properties under different conditions, at low and room temperatures. Currently her research instersts deal with the testing conductivity of molecules such as alkanes, oligo(phenyleneethynylenes), fluorenes, phthalocyanines; and different chemical binding groups such as thiols, amines or C60.

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

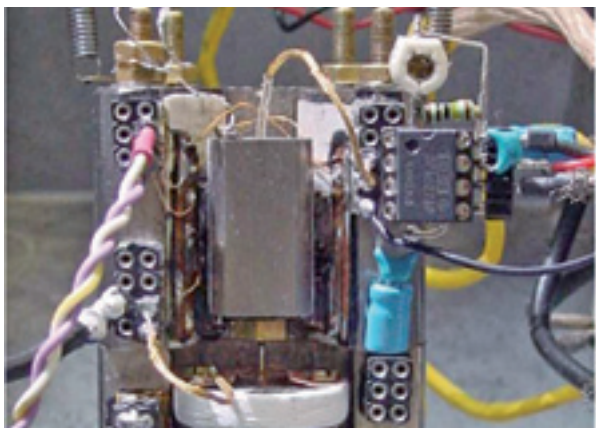
Graduated in Theoretical Physics at UAM (1994), David Pérez de Lara got a PhD from UAM-IC-CNR in 2003. he has had positions at ESA/ESTEC (The Netherlands 2 years), Istituto di Cibernetica of the National Italian Research Council (IC-CNR) , Italian Istituto Nazionale di Fisica Nucleare (INFN) (3 years), '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

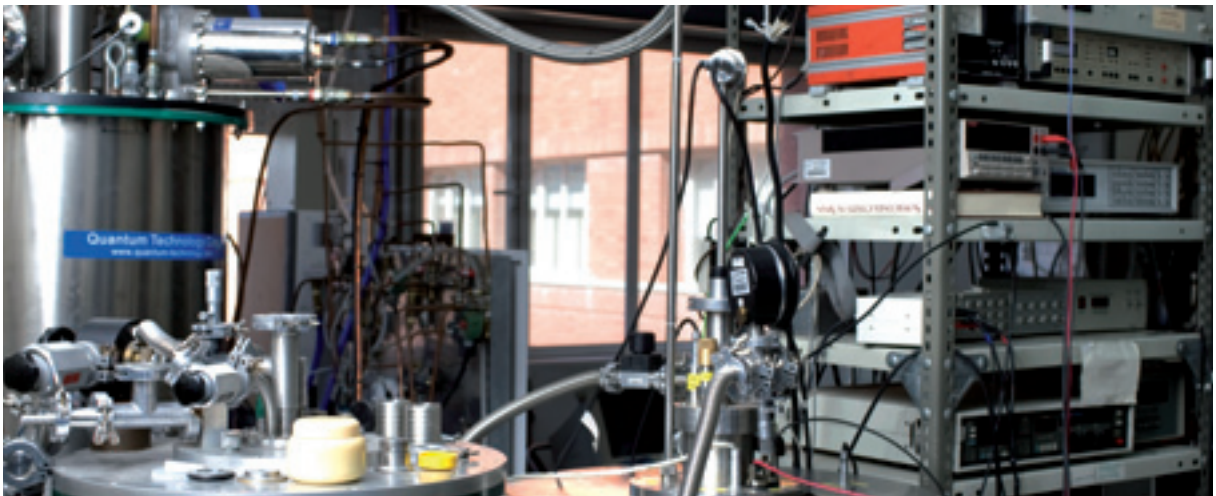
Prof. Miguel Ángel G. García-Tuñón

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 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 appearance of magnetic behavior on nanostructures of non-magnetic materials in bulk state. Recently the work moved toward iron oxide-based nanoparticles and the control of anisotropy in these systems for biomedical applications. Dr. Garcia is also interested in coupling and proximity effect in complex nanostructures, particularly the properties of combined optic (plasmonic & semiconductor) and magnetic nanostructures.

Relevant publications

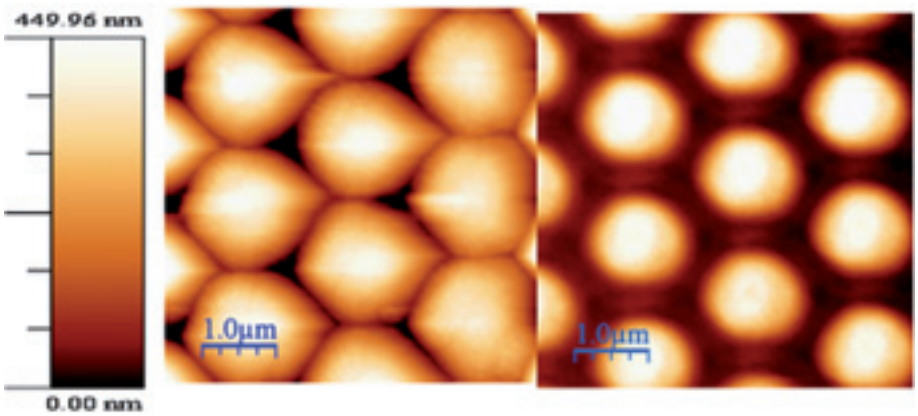
- "Colloidal Synthesis and Characterization of Tetrapod-shaped Magnetic Nanocrystals" P. Davide Cozzoli et col. *Nano Lett.* **6** (2006) 1966-1972.
- "Interface Double-Exchange Ferromagnetism in the Mn-Zn-O System: New Class of Biphase Magnetism" M.A. García et col. *Phys. Rev. Lett.* **94**, 217206, 1-4 (2005).
- "Surface Plasmon Resonance of Capped Au Nanoparticles" M.A. García et col. *Phys. Rev. B (Rapid Comm.)* **72** (2005) 241403, 1-4.



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 Darmstadt, 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

- "Phase-sensitive acoustic imaging and micro-metrology of polymer blend thin films" Ngwa W., *et col. Europhys. Lett.* **64**, 830-836 (2003)
- "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)

Álvaro Alonso

Internship

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

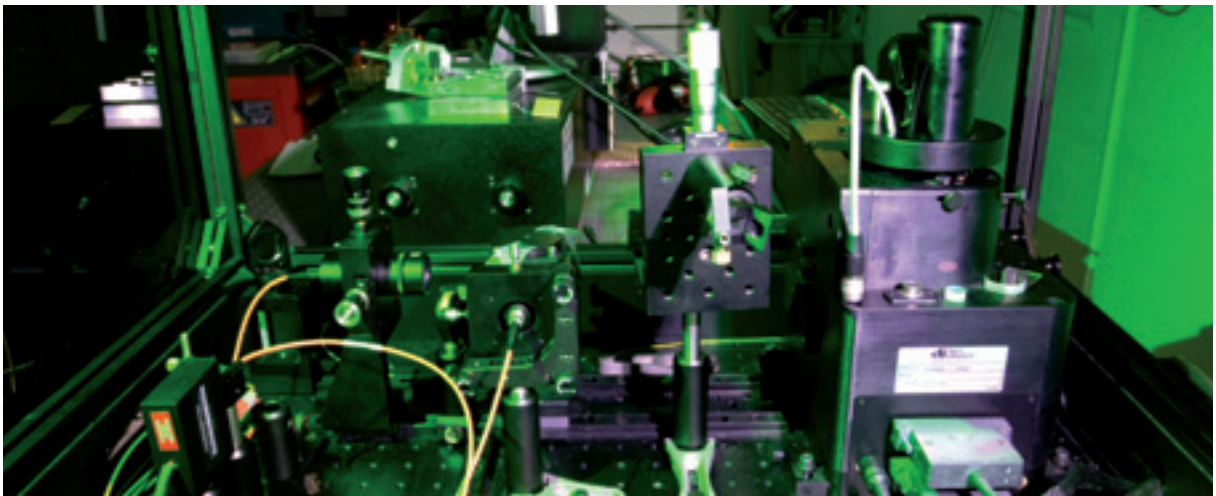
My research interests are the growth and characterisation of semiconductor nanostructures, and the development and characterisation of photonic devices, such as LEDs, LASERS, pillars and photonic crystal cavities, for opto-electronics, quantum optics and quantum information applications.

Relevant publications

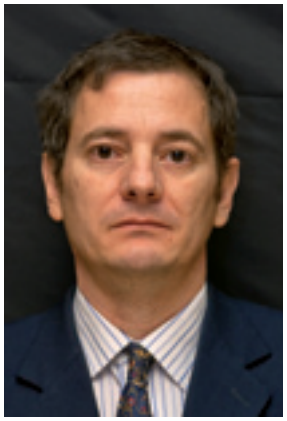
- "Oscillatory persistent currents in self-assembled quantum rings" Kleemans, NAJM, *et al. Phys. Rev. Lett.* **99**, 146808, 1-3 (2007)
- "Manipulating exciton fine structure in quantum dots with a lateral electric field" Gerardot, BD, *et al. Appl. Phys. Lett.* **90**, 041101, 1-3 (2007)
- "In(Ga)As self-assembled quantum ring formation by molecular beam epitaxy". Granados, D., *et al.* Appl. Phys. Lett. **82**, 2401, 1-3 (2003)

Ramón Bernardo

Ph. D. Student



management



Dr. José Luis Casillas
General Manager

Dª Isabel Rodríguez
MS in Administration
Administration and Finance
Manager

Dr. María Jesús Villa
Projects, Institutional
Relations and HR Manager

D. Bonifacio Vega
MSc, MBA
Technology Transfer and
Business Development
Manager

3 scientific infrastructure & labs

3.1. Knowledge transfer

The creation of new knowledge and its transformation into disruptive innovations that generate value is needed to implement an efficient method of producing highly innovative and competitive products and services. The stepping stones in this sequence are SCIENCE >> KNOWLEDGE >> TECHNOLOGY >> APPLICATIONS >> PRODUCTS, thus without science, new knowledge and technological advances it is not possible to come up with innovative applications and products and then the value generating chain stops running and competitive capability is lost. It is therefore essential for governments worried about competiveness to invest in Science, in a coordinated manner with Industry, in order for the latter to benefit from the results of research. With this spirit, IMDEA Nanociencia has focused on generating knowledge, on providing R&D services, and on developments and applications for industrial and commercial use.

The Science and Business relations model adopted by IMDEA Nanociencia provides a specialised framework for the development of new applications and products based on the understanding, analysis and manipulation of nanoscale physical, chemical and biological phenomena. This novel approach provides industry with a new tool to enhance its competitive edge and this is why at IMDEA Nanociencia we encourage companies to invest in nanotechnology. Our sales strategy enables us to offer our customers and collaborators an extensive SERVICES AND APPLICATIONS CATALOGUE which is of great interest and quality as a result of our foundational commitments:

- Carrying out international excellence research projects that generate new scientific and technological knowledge by focusing on understanding fundamental problems that help industry develop new applications, services and products.

- Linking scientific research to social and business demands and establishing flexible, efficient and adaptable programs of cooperation with other institutions and companies

- Supplying advanced services of nanoscale study, research, development and innovation to public sector and private sector users.

Each one of the applied research programs embarked upon by IMDEA Nanociencia has the goal of bringing to the market new developments and advanced applications of nanotechnology for key sectors of the economy. In each program we offer a series of ADVANCED RESEARCH SERVICES, as well as the possibility of directly developing for companies SYSTEMS AND APPLICATIONS that can be sold.

Some of the Spanish companies that are most interested in benefiting from the Institute's activities have begun on joint projects or projects outsourced by companies. Among other applications we can mention the use of magnetic nanoparticles for medical diag-

nosis or as a hyper-thermal anti-tumour treatment, applications in nanostructured coating for the aerospace and defence industries, the use of nanoparticles in advanced graphic printing processes, in new bioclimatic buildings, in the development of instrumentation, in the administration of medicines, and in the development of new solar cells. IMDEA Nanociencia has already established collaboration relationships with the aerospace industry and, in fact, some of the research programs of the IMDEA Nanociencia Institute are very close to the demands of certain markets. Thus the automobile sector is interested in the mechanical and anti-reflective properties of nanoparticles, in the development of magnetic sensors and in the application of giant magneto-resistance. The biotechnology and healthcare industries are interested in nanoparticles as carriers of medicines, in their application in anti-cancer therapies, in the improvement of image diagnosis techniques and precocious detection systems using nanoscope systems, and in the use of nanoparticles and nanomaterials in the remediation of water and in the energy sector.

To facilitate relations with industrial sectors, IMDEA Nanociencia has set up the TECHNOLOGY TRANSFER AND BUSINESS DEVELOPMENT UNIT, which arranges bilateral and sector meetings from time to time. At the new headquarters in Cantoblanco, this unit will have a zone called NANONEST, set up for the creation and development of business spin-off projects emanating from the Institute's research programs and collaboration initiatives to establish start-up companies.

3.2. Advanced laboratory services

The R&D Service Units of IMDEA Nanociencia provide a wide range of scientific services (LABORATORY SERVICES) geared to positioning its activities with the highest quality standards. At IMDEA Nanociencia we encourage the training and preparation of our technical staff to make our services competitive. Our highly qualified personnel use state of the art, innovative technology and equipment to support research groups and private sector companies. To this end, a 'service profile' has been drawn up listing all of the characteristics related to each laboratory, allowing to identify one by one the utility that the services provided by the laboratories below can deliver to prospective customers:

3.2.1. Advanced microscopy and surface science laboratory

This lab is equipped with an Ultra High Vacuum (UHV) chamber that houses a Low Temperature Scanning Tunneling Microscope (LT-STM) which allows experiments in a temperature range that goes from

4.5 ºK up to 300 ºK. In this experimental setup it is possible to deposit ultra thin films of different materials a well as molecular layers and study them by means of scanning tunneling microscopy and spectroscopy. This combination allows us to study the electronic properties at atomic resolution. We can address new problems such as surface diffusion of individual atoms and molecules, catalytic processes at surfaces, the study of standing waves and charge density waves, the study in real space of quantum well states, the magnetic domain structure of surfaces with atomic resolution and the interaction between individual molecules and their vibrational modes.

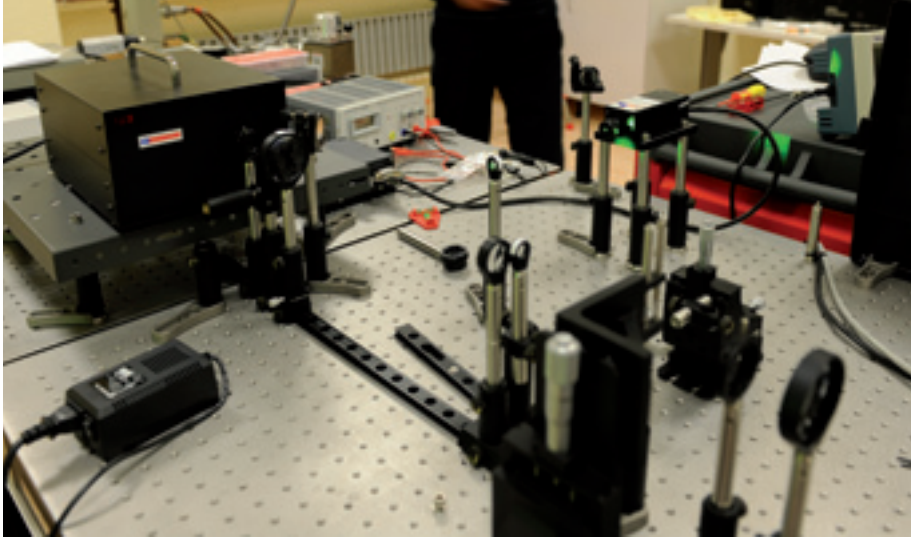
The Atomic Force Microscopy (AFM) lab at IMDEA Nanoscience offers a facility for structural, magnetic or electrostatic surface characterization of different nature (insulator, metallic, proteins, bacterium...). The surface characterization can be performed in contact or tapping mode in air or liquid media. For that purposes, we have two different AFM equipment:

1) JPK Nanowizard II which combines fluorescence and atomic force microscopies providing multitude of applications in Soft Matter and Life Science research

2) Nanotec Cervantes AFM system which integrates different units for contact and tapping measurements in air or liquid media which enables to probe I-V, magnetic, and electrostatic characteristics on any surface or indentation hardness on biomolecules

3.2.2. Nano-optics laboratories

This lab specializes in optical spectroscopy and microscopy, in particular spectroscopy at low temperatures with high spectral and also temporal resolution (picoseconds). Some



of the techniques employed are, for example, pump-probe spectroscopy in the nanosecond to millisecond time range, spectral hole burning (SHB), time-correlated single photon counting (TCPS), Raman spectroscopy, confocal optical microscopy, and near field optical microscopy. Another focus of our work is phase-sensitive ultrasonic probing of the mechanical properties of nanometric objects, including organic and inorganic thin films, in the MHz to GHz frequency range.

The complete photophysic characterization of conjugated materials (organic, inorganic and also biologic materials) and optoelectronic devices can be accomplished in this lab equipped with spectroscopic techniques that cover the entire spectrum, from UV to mid-infrared are available: transmission and reflection spectroscopies, fluorescence and phosphorescence spectroscopies with a resolution between 2 ps and milliseconds, photoinduced absorption spectroscopy time resolved in a regime ranging from 30 fs to milliseconds, electroabsorption spectroscopy, a femtosecond laser equipment, and other electromodulación techniques. Equipment is optimized to detect signals at low optical intensity, as in photovoltaic devices (due to low solar radiation) and molecular electronics (due to low number of molecules). Measurements are made in environmentally controlled or high vacuu, at room temperature or down to 1.5 ºK. The samples studied are samples in solution, in films of varying thickness and optoelectronic devices, being in the latter case possible to test the optical properties during operation.

This lab includes the following Advanced Characterization Services:

- Steady State Electroabsorption spectroscopy. This technique is a useful tool to characterize anionic and cationic features in organic semiconductors. In addition it is a very helpful technique for understanding degradation mechanisms in organic light emitting diodes. Field induced electroabsorption studies allow to elucidate the built-in field across the device active area which is intrinsically related to the work-function difference between cathode and anode. Formation of oxide at the electrodes or chemical impurities at the organic-inorganic interface can therefore be revealed by the associated change in built-in field.

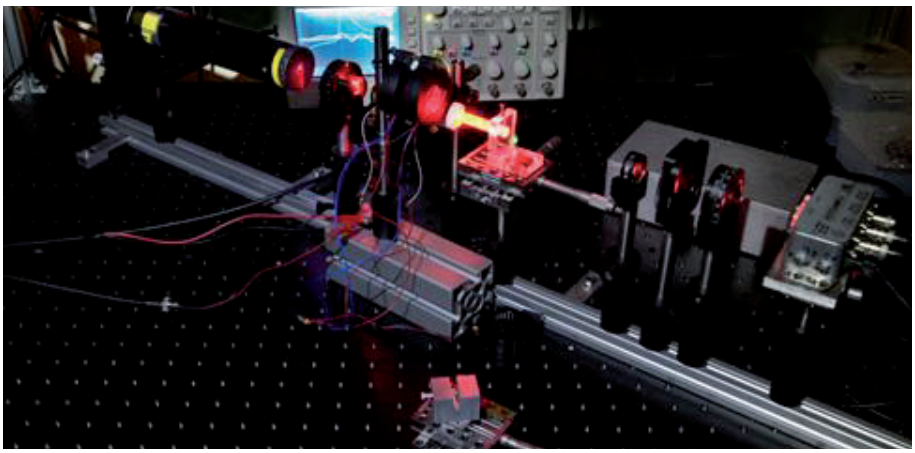
- Photoconductivity measurements. Characterization of the spectral response of photodetectors and solar cells is another activity that can be provided by our laboratory. We can also provide a range of different services such as measuring the monochromatic spectral response, determination of the external quantum efficiency and current-voltage characteristics.

- Transient absorption measurements. We can monitor dynamics of long-lived excited states such as unrelaxed polarons or triplet states. The temporal window detection of this experiment expands from 1 ns to 100 ms. These type of studies are for instance relevant for characterization of photosensitizers in photodynamic therapy, studies of light harvesting biological complexes and characterization of charged states in organic disordered systems.

- Pump-probe spectroscopy. The early dynamics (30 fs – 1ns) of excited states in semiconductors can be probe with this technique. The nature of these states as well as their main decay mechanisms are unravelled by probing across the visible and near infrared. Upon exciting at high fluences it is possible to reveal the presence of annihilation processes which are intrinsically related to the exciton mobility. In molecular materials charged excitations (polarons) can be spectrally distinguish from Frenkel excitons. Monitoring polaron absorption provides information on polaron mobility and recombination processes, of crucial importance for optoelectronic devices

3.2.3. Nanomagnetism laboratory

This lab focuses on the study of the properties of artificial magnetic nanostructures of both organic and inorganic materials, including ultrathin films, multilayers, ordered networks (generated by lithographic processes and self-organization) and nanoparti-

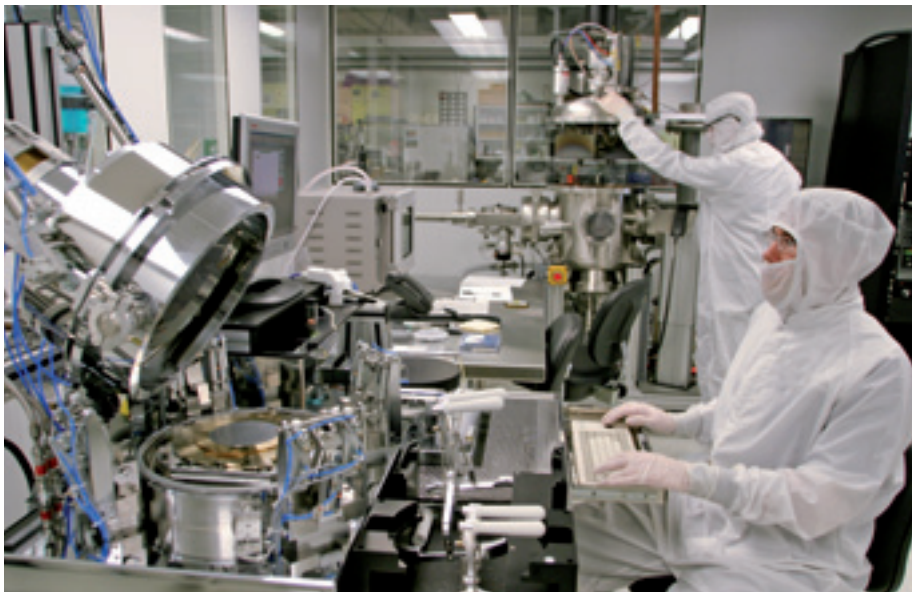


cles, with particular emphasis on the magnetization reversal processes. The nanostructures are grown in ultra-high-vacuum (UHV) by molecular beam epitaxy (MBE) and characterized with standard surface science tools. A more specific organic-MBE system for developing well-controlled organic and hybrid (organic-inorganic) ultrathin film and multilayer nanostructures, has been set-up, towards molecular spintronic.

Two home-made high resolution magneto-optic based magnetometers are available for the magnetic characterization at room temperature. One in reflection (v-MOKE vectorial Magneto-Optic Kerr-Effect magnetometry) and other in transmission (tr-MOFE time-resolved Magneto-Optic Faraday-Effect magnetometry), dedicated for opaque and semi-transparent magnetic nanostructures, respectively. In both set-ups, the magnetic measurements can be performed at different applied field angles (in the whole angular range with an angular resolution better that 0.5º) and with a wide range of dynamic frequencies (i.e., field sweep rates ranging from 1x10-6 T/s to 1x107 T/s). Two new magneto-optic Kerr set-ups are in development: M(R)OKE (dual Magneto-(R)resistance and Magneto-Optic Kerr effect magnetometry) will allow us to study simultaneously the magneto-resistive response and the magnetization reversal processes in magnetic nanostructures at room temperature; LT-vMOKE (Tristan), in which by using a prototype He-cryostat system with in-vacuum rotatory sample motion we could perform the magnetic characterization down to 5 K and up to 500 K.

3.2.4. Nanofabrication centre

A new Nanofabrication Centre is now under construction withis IMDEA Nanociencia building, which will provide advanced services consisting of the manufacturing of tailored nanomaterials, custom nanostructures and sample devices. This Center will operate the new Clean Room. This is a shared facility of the International Excellence Campus UAM+CSIC which will offer a fee-based service laboratory open to outside users and provides highly reduced fee access for academic users. The cleanroom is being equipped for most nano-fabrication needs.



4 scientific report

4.1. Publications & contributions to books

4.1.1. Publications

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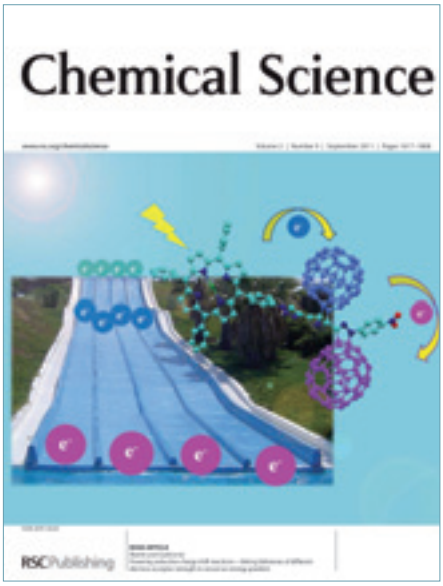

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65. *Direct observation of step-edge barrier effects and general aspects of growth processes: morphology and structure in diindenoperylene thin films deposited on Au (100) single crystals* M. B. Casu, S.-A. Savu, P. Hoffmann, B.-E. Schuster, T. O. Mentes, M. A. Niño, A. Locatelli, T. Chasse *CrystEngComm,* 2011, **13,** 4139-4144 (2011).

66. *Surface assembly of porphyrin nanorods with one-dimensional zinc–oxygen spinal cords* Marta Trelka, Christian Urban, Celia Rogero, Paula de Mendoza, Eva Mateo-Marti, Yang Wang, Iñaki Silanes, David Écija, Manuel Alcamí, Felix Yndurain, Andrés Arnau, Fernando Martín, Antonio M. Echavarren, José Ángel Martín-Gago, José María Gallego, Roberto Otero and Rodolfo Miranda *CrystEngComm*, 2011, **13**, 5591-5595

67. *Subphthalocyanine-polymethine cyanine conjugate: an all organic panchromatic light harvester that reveals charge transfer* Carlos Romero Nieto, Julia Guilleme, Carmen Villegas, Juan Luis Delgado, David González-Rodríguez, Nazario Martin, Tomás Torres and Dirk M. Guldi *J. Mater. Chem.* 2011, **21**, 15914-15918

68. *Helium reflectivity and Debye temperature of graphene grown epitaxially on Ru(0001)* Politano, A.; Borca, B.; Minniti, M.; Hinarejos, JJ; de Parga, ALV; Farias, D.; Miranda, R. *Phys. Rev.* **B84**, 035450, 1-6 (2011)

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70. *Carbon nanotubes/pentacyaneferrate-modified chitosan nanocomposites platforms for reagentless glucose biosensing* Parra-Alfambra, AM. ; Casero, E.; Ruiz, MA. ; Vazquez, L.; Pariente, F.; Lorenzo, E. *Anal Bioanal Chem* (2011) **401**: 883–889

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72. *Magnetostatics and the rotational sense of cycloidal spin spirals* Mikuszeit, N.; Meckler, S.; Wiesendanger, R.; Miranda, R *Phys. Rev.* **B84**, 054404, 1-7 (2011

73. *Making angle resolved photoemission measurement on corrugated monolayers crystals: suspended exfoliated single-crystal graphene* K. R. Knox, A. Locatelli, M. B. Yilmaz, Dean Cvetko, T. O. Mentes, M. A. Niño, P. Kim, A. Morgante, and R. M. Osgood Jr. *Phys. Rev.* **B84**, 115401, 1-12 (2011).

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75. *Organic position sensitive photodetectors based on lateral donor-acceptor concentration gradients* Juan Cabanillas–Gonzalez, Ovidio Peña-Rodríguez, Inma Suarez Lopez, Malte Schmidt, M. Isabel Alonso, Alejandro R. Goñi, and Mariano Campoy–Quiles *Appl. Phys. Lett.* **99,** 103305, 1-3 (2011)

76. *Wraparound Hosts for Fullerenes: Tailored Macrocycles and Cages* D Canevet, E M Pérez and N Martín *Angew. Chem. Int. Ed.* 2011, **50,** 9248-9259

77. *Magnetization textures in NiPd nanostructures* J.-Y. Chauleau, B. J. McMorran, R. Belkhou, N. Bergeard, T. O. Mentes, M.A. Niño, A. Locatelli, J. Unguris, S. Rohart, J. Miltat, and A. Thiaville *Phys. Rev.* **B84**, 094416, 1-8 (2011)

78. *Synthesis of Subphthalocyanines as Probes for the Accessibility of Silica Nanochannels* Ince, M.; Gartmann, N.; Claessens, C.G.; Torres, T.; Bruhwiler, D. *Org. Lett.,* 2011, **13,** 4918-4921

79. *Origin and control of exchange bias-like phenomenon in coupled ferromagnetic [Pt/Co]/NiFe bilayers* A. Bollero, V. Baltz, L. D. Buda-Prejbeanu, B. Rodmacq and B. Dieny *Phys. Rev.* **B84**, 094423, 1-8 (2011)

80. *Carbon tips as electrodes for single-molecule junctions* A Castellanos-Gomez, S Bilan, L A Zotti, CR Arroyo, N Agraït, JC Cuevas, G. Rubio-Bollinger *Appl. Phys. Lett.* **99**, 123105-123116 (2011)

81. *Correlating Magneto-Structural Properties to Hyperthermia Performance of Highly Monodisperse Iron Oxide Nanoparticles Prepared by a Seeded-Growth Route* M. Levy, A. Quarta, A. Espinosa, A. Figuerola,C. Wilhelm, M. García-Hernandez, A. Genovese, A. Falqui, D. Alloyeau, R. Buonsanti, P. D.Cozzoli, M. A.García, F.Gazeau, and T. Pellegrino *Chem. Mater.* **23,** 4170-4180 (2011)

82. *Excited State Switching by Per-Fluorination of para-Oligophenylenes* B. Milián-Medina, S. Varghese, R. Ragni, H. Boerner, E. Ortí, G. M. Farinola, J. Gierschner *J. Chem. Phys.* **135**, 124509, 1-7 (2011)

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84. *Self-Organization of Ultrathin Vanadium Oxide Layers on a Rh(111) Surface during a Catalytic Reaction. Part II: A LEEM and Spectromicroscopy Study* Lovis, F.; Hesse, M.; Locatelli, A.; Mentes, TO.; Nino, MA.; Lilienkamp, G.; Borkenhagen, B.; Imbihl, R. *J. Phys. Chem.* C2011, **115**, 19149-19157

85. *Plasmon-Exciton Interactions on Single Thermoresponsive Platforms Demonstrated by Optical Tweezers* Silvia Hormeño, Neus G. Bastús, Andrea Pietsch, Horst Weller, J. R. Arias-Gonzalez, and Beatriz H. Juarez *Nano Lett.* 2011, **11**, 4742–4747.

86. *Pump-Probe Spectroscopy in Organic Semiconductors: Monitoring Fundamental Processes of Relevance in Optoelectronics* J. Cabanillas-Gonzalez, G. Grancini, G. Lanzani, *Adv. Mater.* 2011, **23,** 5468–5485

87. *Pyrazolinofullerenes: a less known type of highly versatile fullerene derivatives* Juan Luis Delgado, Nazario Martín, Pilar de la Cruz and Fernando Langa *Chem. Soc. Rev.* 2011, **40**, 5232–5241. **Cover article**

88. *Magnetic pinning of flux lattice in superconducting-nanomagnet hybrids* D. Perez de Lara, F. J. Castaño, B. G. Ng, H. S. Körner, R. K. Dumas, E. M. Gonzalez, Kai Liu, C. A. Ross, Ivan K. Schuller and J. L. Vicent *Appl. Phys. Lett.* **99,** 182509, 1-3 (2011)

89. *Role of Deprotonation and Cu Adatom Migration in Determining the Reaction Pathways of Oxalic Acid Adsorption on Cu(111)* MN. Faraggi, C. Rogero, A. Arnau, M. Trelka, D. Ecija, C. Isvoranu, J. Schnadt, C. Marti-Gastaldo, E. Coronado, JM Gallego, R. Otero, R. Miranda *J. Phys. Chem.* C2011, **115,** 21177-21182

90. *Tuning Interchain and Intrachain Interactions in Polyfluorene Copolymers* Y.-S. Huang, J. Gierschner, J. P. Schmidtke, R. H. Friend, D. Beljonne *Phys. Rev.* **B84**, 205311, 1-7 (2011)

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92. *The genome of Tetranychus urticae reveals herbivorous pest adaptations* Miodrag Grbiç,…, M. Vélez,….,Yves Van de Peer *Nature* **479**, 487–492 (2011)

93. *Free-carrier generation in semiconducting single-wall carbon nanotube aggregates*, J. J. Crochet, S. Hoseinkhani, L. Lüer, T. Hertel, S. K. Doorn, and G. Lanzani *Phys. Rev. Lett.* **107,** 257402, 1-5 (2011)

94. *Diffraction of molecular hydrogen from metal surfaces* Daniel Farias and Rodolfo Miranda *Progress in Surface Sciences* **86** (2011) 222–254

95. *Formation of self-assembled chains of tetrathiafulvalene on Cu(100) surface* Yang Wang, Christian Urban, Jonathan Rodríguez-Fernández, José M. Gallego, Roberto Otero, Nazario Martín, Rodolfo Miranda, Manuel Alcamí, Fernando Martín *J Phys Chem A.* 2011 **115,** 13080-13087

96. *Molecular Self-Assembly at Solid Surfaces* Roberto Otero, José M. Gallego, Amadeo L. Vázquez de Parga, Nazario Martín, and Rodolfo Miranda *Advanced Materials* **23,** 5148-5176 (2011)

4.1.2. Contributions to books

1. G. Lanzani, L. Lüer **Carbon Nanotubes: Electronic Structure and Spectroscopy,** in *Comprehensive Nanoscience and Technology, Elsevier B,V.* (London) (2011)

2. Juan Luis Delgado, Nazario Martín and D. M. Guldi **Mimicking Photosynthesis with Fullerene-Based Systems** in *Supramolecular Soft Matter: Applications in Materials and Organic Electronics,* Chapter 21, 431-450 (2011)

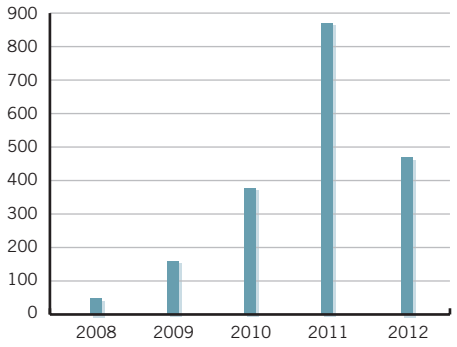
3. Angy L. Ortiz, Luis Echegoyen, Juan Luis Delgado and Nazario Martín **Reactions and retro-reactions of Fullerenes** in *Handbook of Carbon Nanomaterials, Volume 1, Synthesis and Supramolecular Systems,* Chapter 10, 325-373, 2011

4. De Pablo, P.J. and Carrión-Vázquez, M. **Imaging biological samples using atomic force microscopy** in *Optical Imaging Techniques: A Laboratory Manual Yuste, R. (Ed.), Columbia University,* New York, 2011. ISBN 978-0-879699-36-9

5. R.Wannemacher **Confocal Laser Scanning Microscopy** in *Encyclopedia of Nanotechnology, Springer Science + Business Media,* 2011. In print

contributions to books

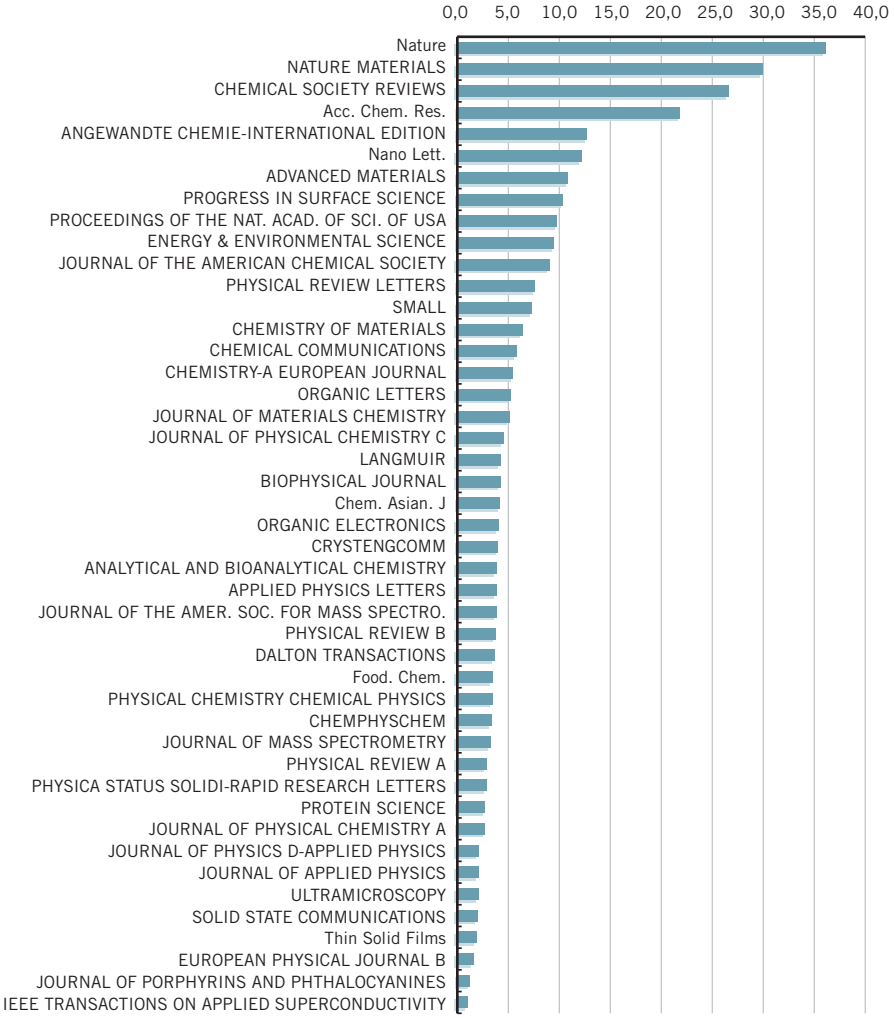
Citations in each year



- **Sum of the times cited:** 1924
- **Institutional h index:** 22
- **Average citation per item:** 8.77

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: 191

Impact factor of the publications in 2011



Average impact factor: 6,405

4.2. International Congresses: Regular Contributions and Invited Lectures

26.1.2011

Photonics West, San Francisco, USA

Poster (Invited)

"Ultrafast exciton and charge transfer in small aggregates of carbon nanotubes" L. Lüer, S. Hoseinkhani, J. Crochet, T. Hertel, G. Lanzani, D. Brida, D. Polli, G. Cerullo.

03.-05.02.2011

Symposium CPiC, Limoges, France

Oral presentation

"Exciton Injection and Transport in Nanostructured Supramolecular Assemblies" J. Gierschner

10-11.02.2011

FUNMOLS Workshop on Molecular Electronics, Bern, Switzerland

Oral presentation

"Imaging and lifting single C60 dumbbell molecules", Ch Evangeli, E Leary, MT Gonzalez, and N Agraït

Poster

"Contacting single molecules with a scanning tunneling microscope" Edmund Leary, Ch. Evangeli, M. Teresa Gonzalez, G Rubio-Bollinger, and Nicolás Agraït

05-09.03.2011

Biophysical Society 55th Annual Meeting, Baltimore, USA.

Poster

"Unwinding Dynamics of a Processive DNA Polymerase. Ibarra, B., Morín, J.A., Arias-Gonzalez R.J., Salas, M., Valpuesta, J.M., Carrascosa, J.L.

01-04.06.2011

XI Congress of the Spanish Biophysicla Society, Murcia, Spain

Poster

"A single-molecule comparison of the mechanical properties of dsRNA and DNA" E. Herrero-Galán, J.M. Valpuesta, J.L. Carrascosa, J.L., J.R. Arias-González.

international congresses

11-14.04.11

Imaginenano-NanoSpain Conf. 2011, Bilbao, Spain

Oral presentation

"Breast cancer cell death induced by magnetic nanoparticles subjected to AC magnetic fields". F.J. Terán, A. Bollero, M. Calero, P. Acedo, A. Villanueva, M.P. Morales, J. Camarero and R. Miranda.

Poster

"Breast cancer cell death induced by magnetic nanoparticles subjected to AC magnetic fields" F.J. Terán, A. Bollero, M. Calero, P. Acedo, A. Villanueva, M.P. Morales, J. Camarero and R. Miranda

11.04.2011

LHP 2011, Kloster Banz, Germany

Oral presentation

"Energy Backtransfer in Photosynthetic Membranes from High Light and Low Light Grown Purple Bacteria" L. Lüer, V. Moulisova, S. Henry, T. Brotosudarmo, R. Cogdell, S. Hoseinkhani, D. Polli, D. Brida, G. Cerullo, G. Lanzani.

29.05-01.06.2011

Chinese-German Symposium on Nanomanufacturing and Nanotribology, Berlin, Germany

Invited Lecture

"Anisotropy effects in atomic-scale friction", E. Gnecco.

01-04.06.2011

XI Spanish Society of BiophysicsMeeting (SEB-XI), Murcia, Spain.

Oral Presentation

"Oligonucleótidos Modificados en Nanotecnología"A. Somoza

08-10.06.2011

International workshop on nanoplasmonics for energy and the environment. Vigo. Spain

Poster

"Plasmon-exciton interactions on single thermoresponsive platforms demonstrated by optical tweezers" S. Hormeño, N. G. Bastús, A. Pietsch, H. Weller, J. R. Arias-González and B. H. Juárez.

POSTER AWARDED AS "BEST POSTER"

09-10.06.2011

VIII Nucleic Acid and Nucleosides Meeting (RANN-VIII), Sevilla, Spain

Oral Presentations

"Oligonucleótidos Modificados en Nanotecnología" A. Somoza

"The B-A transition in DNA: a study at the singlemolecule level. J.R. Arias-González

16-17.06.2011

IBERTRIB 16, Madrid, Spain

Invited Plenary Lecture

"Recent developments in nanotribology: Electron vs phonon damping mechanisms, superlubricity and controlled manipulation", Enrico Gnecco.

23.06.2011

Gordon Research Conference, Proteins. Holderness Sc, Plymouth, NH, USA

Invited Lecture

"Modulating stability and self-assembly studies of repeat proteins" Aitziber Lopez Cortajarena.

29.06-1.07.2011

Workshop Trends on Nanoscale Superconductivity and Magnetism Cali Colombia.

Invited Lecture

J. L. Vicent

09-12.07.2011

Particles 2011, Stimuli Responsive Particles and Particle Assemblies. Berlin, Germany

Poster

"Fighting cancer with magnetic nanoparticles" G. Salas, M. Calero, F.J. Terán, A. Bollero, A. Villanueva, J. Camarero, R. Miranda, and M.P. Morales

11.7.2011

ERPOS 2011, Vilnius, Lithuania

Poster

"Ultrafast exciton and charge dynamics in Isolated and Interacting Carbon Nanotubes", L. Lüer, invited talk

17-20.07.2011

9th Triennial Congress of The World Association of Theoretical and Computational Chemists (WATOC)

Poster

"Backbone flexibility in substituted polythiophenes" B. Milián-Medina, J. Aragó, E. Ortí, J. Gierschner

24-27.07.2011

Excited states and nonadiabatic processes in complex systems.
Theoretical approaches. Sant Feliu de Guíxols, Girona, Spain

Oral Presentation

"Directional Exciton Transport and Injection in Nanostructured Supramolecular Assemblies" J. Gierschner

24-28.07.2011

XXXIII Royal Spanish Society of Chemistry Meeting (RSEQ-XXXIII), Valencia Spain.

Oral Presentation

"Oligonucleótidos Modificados en Nanotecnología" A. Somoza

28.08-02.09.2011

28th European Conference on Surface Science (ECOSS-28), Wroclaw, Poland

Oral presentation

"Anisotropy effects in atomic-scale friction" E. Gnecco

"Interfacial effects of the magnetism in the metastable fcc FeCu alloys" M.A. Niño, F. J. Luque, T. O. Mentes, I. Kowalik, A. Locatelli, D. Arvanitis, R. Miranda, J.J. de Miguel

Poster

"A Helium Diffraction Study of Graphene Grown on Ru(0001)" D. Maccariello, A. Al Taleb, P. Perna, M. Minniti, D. Farías, R. Miranda

"Natural X-ray dichroism in chemisorbed films of chiral molecules" F. J. Luque, M.A. Niño, I. Kowalik, D. Arvanitis, R. Miranda, J.J. de Miguel

05-06.09.2011

FUNMOLS Workshop on Molecular Electronics, Barcelona, Spain

Oral presentation

"Contacting dumbbell molecular wires" Charalambos Evangeli, Edmund Leary, M. Teresa Gonzalez and Nicolás Agraït

Poster

"Locating and Lifting a Single Molecular Wire" E. Leary, M. T. González, G. Rubio-Bollinger, N. Agraït, C. Van der Pole, M. R. Bryce, S. Filippone, N. Martín

08-10.09.2011

XXXIV Congress of the Spanish Society of Biochemistry and Molecular Biology (Sociedad Española de Bioquímica y Biología Molecular).Barcelona. Spain

Invited Oral Presentations

"The B-A transition in DNA: a study at the singlemolecule level. J.R. Arias-González

03-07.10.2011

11th International Conference on Atomically Controlled Surfaces, Interfaces and Nanostructures ACSIN-11, St. Petersburg, Russia

Oral presentation

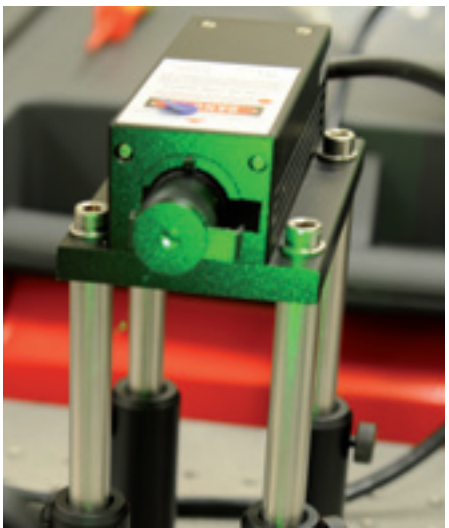
"Nanostructure formation and nanopatterning on low index and vicinal silicon surfaces" Falta, Th. Schmidt, M. Speckmann, I. Heidman, J.I. Flege, A. Locatelli, T.O. Mentes, M. A. Niño, P. Sutter, C. Klein, T. Nabbefeld, F.J. Meyer zu Heringsdorf, M. Horn von Hoegen

07-10.09.2011

ECME11: European Conference on Molecular Electronics, Barcelona, Spain

Oral presentation

'Reliable Anchoring Groups for Single-Molecule Junctions', M.T. González , E. Leary , C. Arroyo, C. Evangeli, G. Rubio-Bollinger, N. Agraït.



Posters

'Contacting Single Molecules with a Scanning Tunneling Microscope', C. Evangeli, E. Leary, M. T. González, N. Agraït.

"Locating and Lifting a Single Molecular Wire", E. Leary, M. T. González, G. Rubio-Bollinger, N. Agraït, C. Van der Pole, M. R. Bryce, S. Filippone, N. Martín.

"Oligothienoacenes versus oligothiophenes: Impact of rinf fusion on the optical properties" J. Aragó, P.M. Viruela, J. Gierschner, E. Ortí, B. Milián-Medina

08-09-09.2011

ELFOS Workshop, Barcelona, Spain

Oral presentation

"Contacting Single-Molecule Magnets with STM" E. Leary, Ch. Evangeli, S. Sherif, G. Rubio-Bollinger, N. Agraït.

12-16-09.2011

FANAS Conference on Trends in Nanotribology, Trieste, Italy

Oral presentation

"Anisotropy effects in atomic-scale friction" E. Gnecco

18-22.09.2011

NANOSCALE PATTERN FORMATION AT SURFACES El Escorial, Madrid, Spain

Poster

"Scanning Nearfield Optical Microscopy of Nano-Electro-Mechanical Systems for Photonic Applications". Daniel Granados, Ramon Bernardo

26.09.2011

1st Advanced and Integrated Medical Imaging for Europe (AMI4EUROPE) Conference Hospital Clínico San Carlos. Madrid, Spain

Oral presentation

"Multifunctional nanotechnology for selective detection and treatment of cancer" A. Bollero

03-07.10.2011

ACSIN-11th International Conference on Atomically Controlled Surfaces, Interfaces and Nanostructures St. Petersburg, Russia

Oral presentations

"Tailoring magnetic properties of half metallic La0.7Sr0.3MnO3 thin films" P. Perna, C. Rodrigo, E. Jimenez, J.L.F. Cunado, N. Mikuszeit, L. Mechin, J. Camarero & R. Miranda

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

"Dynamic magnetic properties of ferrite nanoparticles for thermal applications in cancer treatment" A. Bollero, F.J. Teran, J.L.F. Cunado, M.P. Morales, G. Salas, A. Villanueva, M. Calero, P. Acedo, G. Garcia, J. Camarero, and R. Miranda

Poster

"Exploring the limits of soft x-ray magnetic holography: imaging magnetization reversal of buried interfaces" E. Jimenez, J. Camarero, J. Vogel, P. Perna, A. Bollero, F. Yakhou-Harris, C. Tieg, C. Arm, B. Rodmacq, E. Gautier, S. Auffret, B. Delaup, G. Gaudin, B. Dieny, and R. Miranda

12-18.10.2011

2nd Joint Congress of The Portuguese and Spanish Microscopy Societies. Aveiro, Portugal

Poster

"Structural and functional characterization of phage T7 infection complexes". : Gonzalez-Garcia VA., Cuervo A., Pulido M., Chichón FJ., Valpuesta J.M. and Carrascosa J.L

Oral presentations

"Structure of the Phage T7 terminase and its implications in DNA translocation" I. Daudén, J. Martín-Benito, R. Arranz, M. Valle, J. C. Sánchez and J. L. Carrascosa

"The structure of the in vivo assembled CCT:G protein β1 subunit complex reveals a novel CCT substrate binding mechanism mediated by hydrophobic interactions" Jorge Cuéllar, Chun Wan J. Lai, Rebecca L. Plimpton, Kara T. Haines, Caleb J. Stowell, José L. Carrascosa, Barry M. Willardson and José M. Valpuesta

Oral (invited)

"Biophysics of centrosomes and DNA studied by optical manipulation". S. Hormeño, B.Ibarra, B. M. H. Lange, F. Moreno-Herrero, J. L. Carrascosa, J. M. Valpuesta, J. R. Arias-González

21-23.10.2011

V Workshop sobre Nanociencia y Nanotecnología Analíticas 2011. Toledo, Spain

Poster

"Electrodos funcionalizados con redes de nanopartículas de oro electropolimerizadas para el diseño de biosensores enzimáticos" R. Villalonga, P. Díez, S. Casado, M. Eguílaz, P. Yáñez-Sedeño, J.M. Pingarrón.

24-26.10.2011

"Synthesis and design of multi-functional materials and heterostructures" MAMA-SYNT Workshop. Naples, Italy

Oral presentation

"Tailoring magnetic properties of nanostructures" P. Perna1, J. Camarero, C. Rodrigo, A. Bollero, D. Maccariello, L. Méchin, E. Jiménez, N. Mikuszeit, and R. Miranda

30.10-04.11.2011

56th Annual Conference on Magnetism and Magnetic Materials-MMM Scottsdale, Arizona, USA

Posters

"Magnetic properties and thermal response of magnetite nanoparticles under dynamical conditions of external magnetic field application" A. Bollero, F.J. Teran, C. Casado, J.F. Cunado, M. Morales, G. Salas, A. Villanueva, M. Calero, P. Acedo, J. Camarero, and R. Miranda

POSTER AWARDED AS "BEST POSTER"

"On the road to custom-designed epitaxial thin films by controlled magnetic anisotropy symmetry breaking" E. Jimenez, N. Mikuszeit, A. Bollero, P. Perna, C. Rodrigo, C. Clavero, J.M. García-Martín, A. Cebollada, J. Camarero, and R. Miranda

Oral presentations

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

"Tuning the isothermally-induced exchange-bias in perpendicularly coupled ferromagnetic [Pt/Co]/NiFe multilayers" A. Bollero, V. Baltz, L.D. Buda-Prejbeanu, P. Perna, J. Sort, J. Nogués, B. Rodmacq, J. Camarero, R. Miranda, and B. Dieny

"Towards tailoring magnetic properties in exchange-biased FM/AFM systems" E. Jimenez, J. Camarero, N. Mikuszeit, P. Perna, F.J. Teran, A. Bollero, J. Sort, J. Nogués, J.M. García-Martín, A. Hoffmann, B. Dieny, and R. Miranda

18-23.10.2011

Fπ10 International Symposium on Functional π-electron systems Beijing, China

Oral presentation

"Carbon-based materials for the preparation of efficient photovoltaic devices: All organics and Hybrid Solar Cells" Juan L. Delgado

24-28.10.2011

International scientific conference on Photovoltaics at the Nanoscale. Hasselt, Belgium

Poster

"Photodegradation in conjugated polymers" Aranzazu Aguirre

28.11-02.12.2011

Material Research Society Fall Meeting. Boston, USA

Oral contribution

"Oxygen induced degradation in conjugated polymers" Aranzazu Aguirre

Poster

"Plasmon-exciton interactions on single thermoresponsive platforms demonstrated by optical tweezers" S. Hormeño, N. G. Bastús, A. Pietsch, H. Weller, J. R. Arias-González and B. H. Juárez.

05-06.12.2011

International Summit on Organic Photovoltaic Stability. Golden, USA

Invited oral contribution

"Solar cell photodegradation. In depth look into photodegradation" Aránzazu Aguirre

06-10.12.2011

Workshop on Frontiers of Superconductivity and Magnetism Materials: Mechanisms and Applications. Recife, Brasil

Invited Lecture

J. L. Vicent

07-09.12.2011

International Conference on Advance Materials and Devices, ICAMD 2011, Jeju, Korea

"Using Optical Tweezers to Study DNA Replication Dynamics at Single-Molecule Level". B. Ibarra. Invited Lecture

12-15.12.2011

XIV Congress of the Spanish Society for Cell Biology, Málaga, Spain

Oral Presentation

"Dimercaptosuccinic acid-coated magnetite nanoparticles as a localized interferon-gamma delivery system for cancer immunotherapy". Mejías R, Pérez-Yagüe S, Gutiérrez L, Cabrera LI, Spada R, Acedo P, Serna CJ, Lázaro FJ, Villanueva A, Morales M del P, Barber DF

Poster

"Design and potential application of magnetic iron oxide nanoparticles for cancer therapy". Calero M, Villanueva A, Salas G, Morales MP, Terán F, Bollero A and Miranda R.

POSTER AWARDED AS "BEST POSTER"

"PEG coated iron oxide nanoparticles for biotechnology applications". Ruiz GA, Salas G, Calero M, Villanueva A and Morales MP

lectures, seminars, workshops & courses

IMDEA Seminars Every Tuesday at 12.00

4.3. Lectures, Seminars, Workshops & Courses (Co)-Organized by Imdea-Nanociencia

26.01.2011

"Optical and Electronic Properties of Conjugated Organic Materials: a Lesson from Theory and Spectroscopy" Institute of Solid State Physics, Graz University of Technology, Graz, Austria **J. Gierschner**

14-15.02.2011

"Controlled single molecule experiments using STM" ELFOS Kick-off Meeting, Delft, The Netherlands. **N. Agraït**

17-18.02.2011

1st Workshop on "Nanobiomagnet: Fundamentos y Aplicaiones de Moléculas, Nopartículas y Nanoestructuras Magnéticas: de la espintrónica a la biomedicina" S2009MAT-1726. Madrid, Spain

13.04.2011

Optical Spectroscopy & Microscopy of Nanostructured Systems

NanoLum Meeting, Rome, Italy **J. Gierschner**

20.05.2011

1st O_2-Symposium on Reversible & Irreversible Degradation of Conjugated Materials, IMDEA Nanoscience, Madrid, Spain **J. Gierschner, L.Luer & R. Wannemacher**

02-03.06.2011

1st Symposium on "Carbon Nanoforms", Madrid, Spain Co-Organizer & Member of the organizing committee: J.L. Delgado Molecular Materials Institute (INAMOL-UCLM)

09-13/06/2011 Spring meeting of the European Materials Research Society (E-MRS 2011). Nice, France

Symposium E – From Photophysics to Optoelectronics of Zero- and One-dimensional Nanomaterials. Co-Organizer: **L. Lüer**

20-21.06.2011
1st IMDEA Early Stage Researcher Workshop, Madrid, Spain **Imdea Nanociencia**

05-06.09.2011
FUNMOLS Workshop on Molecular Electronics, Barcelona, Spain **N. Agraït**

08-09.09.2011
ELFOS Workshop, Barcelona, Spain **N. Agraït**

28.09.2011
"3D exciton coupling, injection and transport in weakly coupled systems" Laboratory for Chemistry of Novel Materials, University of Mons, Belgium, **J. Gierschner**
"Carbon-based materials for the preparation of efficient photovoltaic devices" **Juan Luis Delgado**

- 10.10.2011 *Chinese Academy of Sciences, Institute of Chemistry, Beijing, China, 2011*
- 10.10.2011 *Chemical Physics Chinese Academy of Sciences, Dalian, China, 2011*

10-11.10.2011
Optical Spectroscopy & Microscopy of Nanostructured Systems. IMDEA Contribution to the *Confine* and *NanoLum+* projects, Madrid Meeting, **J. Gierschner**

18-21.10.2011
Symposium "Physics at the nanoscale", Madrid, Spain **Imdea Nanociencia**

14.11.2011
"Reversible oxygen effects in P3HT:PCBM solar cells", group seminar of Prof. Feldmann, LMU Munich, Germany. **L. Lüer**

15.11.2011
"Photoexcitation dynamics in organic photovoltaic devices". Invited presentation at Konarka Technologies GmbH, Nuernberg, Germany, **L. Lüer**

4.4. Projects, Fellowships and Internships

4.4.1. Projects

International programs

Marie Curie Action. FP7-PEOPLE-2007-2-3-COFUND Co-funding of Regional, National and International Programmes. AMAROUT. nº 229599. IMDEA Nanociencia. *2009 (48 months)*

Marie Curie Actions. European Re-integration Grants (ERG). FP7-PEOPLE-2009-RG DOTUBE: Interactions between semiconductor nanoparticles and carbon nanotubes. nº 239256 Dr. Beatriz Hernández. *2009 (36 months)*

Marie Curie Actions. International Re-integration Grants (IRG). FP7- PEOPLE-2009-RG BIONANOTOOLS: Protein design to generate bio-functional nanostructures. nº 246688 Dr. Aitziber López-Cortajarena *2010 (48 months)*

MARIE CURIE ACTIONS International Research Staff (IRSE). FP7-PEOPLE-2009-IRSES ONDA Prof. R. Miranda & Dr. Julio Camarero *2010 (48 months)*

FP7-NMP-2010-LARGE-4. MULTIFUn: Multi-Functional Nanotechnology for Selective Detection and Treatment of Cancer. MULTIFUn. nº 262943-2. Dr. Aitziber López-Cortajarena, Dr. Álvaro Somoza, Dr. Francisco Terán & Prof. Angeles Villanueva *2011 (48 months)*

MARIE CURIE ACTIONS Initial Training Networks (ITN) Scheme Call: FP7-PEOPLE-2011-ITN ESTABLIS—Ensuring STABiLIty in organic Solar cells Dr. Larry Luer *2012 (48 months)*

MARIE CURIE ACTIONS International Outgoing Fellowships (IOF). FP7-PEOPLE-2010-IOF

NANOTEST: Fabrication and development of nanotoxicology-test bacterial arrays for the investigation of antibiotics against multi drug-resistant bacteria. Nº 275148 Dr. Ramses. V. Martínez *2012 (36 months)*

European Science Foundation (ESF*) "Chemistry with Ultrashorts Pulses and Free-Electron Lasers: looking for control strategies through *exact* computations European Science Foundation" COST Action. CM0702-1* Prof. Fernando Martín *2010 (24 months)*

EU FP7-REGPOT-2010-1
MAMA: Unlocking research potential for multifunctional advanced materials and nanoscale phenomena. Nª 264098 Prof. R. Miranda & Dr. Paolo Perna *2010 (42 months)*

EU -FP7-ICT2009-6
ELFOS Electric Field control over Spin Molecules Dr. Nicolas Agrait *2011 (36 months)*

European Theoretical Spectroscopy Facility (ETSF) *MINT Mechanically interlocked carbon nanotubes* Dr. Emilio Pérez *2010 (24 months)*

National Natural Science Foundation of China (China NNSF) *"Interface design, fabrication and property investigation in magneto-electric composite ultrathin films"* Dr. Feng Luo *2011 (24 months)*

National Natural Science Foundation of China (China NNSF) *"Design and preparation of interface construction in layered magneto-electric composite materials",* Dr. Feng Luo *2011 (48 months)*

Stays at International Scientific Facilities:

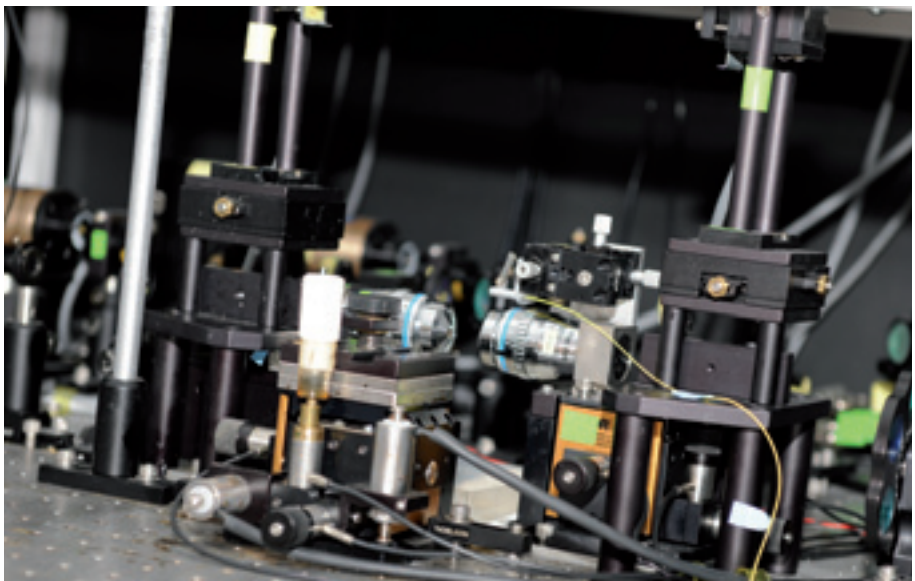
01.02.2011-14.02.2011
MaxLab Synchrotron, Lund, Sweden
Project: "Surfactant assisted growth of metastable magnetic FeCu alloy thin films" **M.A. Niño**

06.03.2011-14.03.2011
Elettra Synchrotron, Trieste, Italy
Project: "Semicondutor nano-magnetism by phase separation: (Ga,Fe)N and (Ga, Mn)N" **M.A. Niño**

National programs

MICINN. *MAT2009-13488. "Growth and characterization of new nanomaterials based on self-assembled quantum dots and carbon nanotubes on solid surfaces"* Dr. Beatriz Hernández & Dr. Roberto Otero *2009 (36 months)*

MICINN. *SAF2010-15440. "Oligonucleótidos modificados en Medicina: Detección de secuencias de ácidos nucleicos e inhibición de la expresión génica mediante ARN interferente"* Dr. Álvaro Somoza *2010 (36 months)*



MICINN. *TEC2010-21830-C02-02 "Amplificadores ópticos basados en polímeros conjugados para sensores químicos"* Dr. Juan Cabanillas *2010 (36 months)*

MICINN. *MAT2010-21822-C02-01 "Optimisation of functional NANOparticles as a novel, minimalinvasive and efficient therapy for targeting Cancer Stem Cell (NANOvsCSC)"* Dr. Francisco Terán *2010 (24 months)*

MICINN. *MAT2011-25598 "Sistemas espintrónicos perpendiculares: procesos de inversión de imanación en naoestructuras con acoplamiento de canje perpendicular"* Dr. Alberto Bollero *2011 (36 months)*

MICINN. *MAT2011-26312 "Fricción a nanoescala: efectos de la anisotropia e influencia de excitaciones mecánicas"* Dr. Enrico Gnecco *2010 (12 months)*

MICINN. *CTQ2011-27317 "Materiales moleculares conjugados diseñados mediante control intra e intermolecular"* Dr. Johannes Gierschner *2011 (36 months)*

MICINN. *CTQ2011-25714 "Síntesis de máquinas moleculares avanzadas"* Dr. Emilio Pérez *2011 (36 months)*

MICINN. *CTQ2011-27934 "Colorantes orgánicos para la preparación de células solares"* Dr. Juan Luis Delgado *2010 (12 months)*

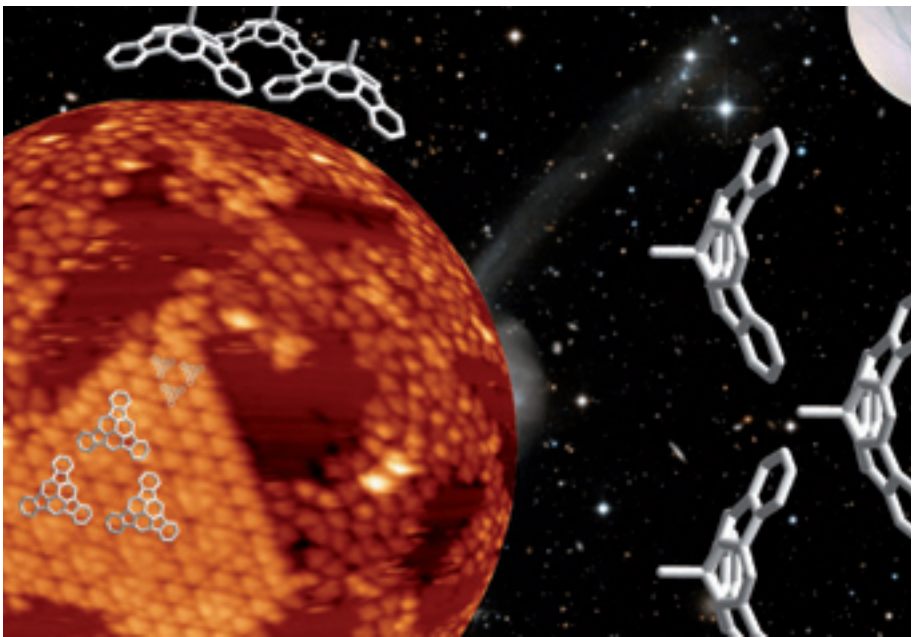
CM *S2009/MAT-1726 NANOBIOMAGNET: fundamentos y aplicaciones de moléculas, nanopartículas y nanoestructuras magnéticas: de la espintrónica a la biomedicina.* IMDEA Nanociencia (Dr. Johannes Gierschner & Dr. Reinhold Wannemacher) 2010 (48 months)

CM *S2009/PPQ-1553 MadriSolar2: Materiales foto y electroactivos para células solares orgánicas e híbridas.* IMDEA Nanociencia (Dr. Larry Luer) *2010 (48 months)*

Dr. Velez (CSIC) & Dr. Carrión (CSIC*) participate in* CM *S2009MAT-1507 NOBIMAT-M: Nuevos materiales y dispositivos biofuncionales híbridos en Nanociencia 2010 (48 months)*

Dr. Gonzalez participates in *"Transporte eléctrico a través de moléculas individuales y nanocintas de grafeno" MICINN. FMAT2008-01735 2010 (36 months)*

Dr. Delgado & Dr. Pérez participate in *"FullSol@r: Fullerenos endoédricos químicamente modificados para aplicaciones fotovoltáicas" MICINN PLE-2009-0168. Acción de Coordinación España-Japón 2010 (36 months)*



fellowship internships

Dr. Somoza participates in CSIC/NSC "Formosa Program" Cooperative Research Projects (CRPs). Characterization Of Novel Drug Delivery Systems 2009TW0031 2010 (36 months)

Industrial projects

MICINN. CDTI
Innovación en composites avanzados y rear-end optimizado (ICARO) with AERNNOVA ENGINEERING SOLUTIONS IBERICA S.A. 2008 (48 months)

MICINN. INNPRONTA
Investigación En Tecnología Espacial Sobre Plataforma UAV Perigeo Deimos Space, S.L.U with AERNNOVA ENGINEERING SOLUTIONS IBERICA S.A. 2011 (48 months)

4.4.2. Fellowship

7FP Marie Curie Action. AMAROUT.
- Incoming Fellowships: Fabián Calleja, Miguel Angel Niño, Aránzazu Aguirre, Shinto Varghese, Damien Joly
- Renewal:
  - Incoming Fellowships: Paolo Perna, Larry Luer and David Canevet, Enrico Gnecco, Feng Luo
  - Reintegration Fellowships: Aitziber Lopez-Cortajarena

Spanish Ministry of Science and Innovation
Ramon y Cajal Programme
- 2011 Dr. Francisco Terán; Dr. Cristina Flors; Dr. Begoña Sot
- 2009 Dr. Larry Luer, Dr. Juan Cabanillas
- 2008 Dr. Emilio Pérez, Dr. Juan Luis Delgado, Dr.Teresa González
- 2007 Dr. Johannes Giershner, Dr. Ricardo Arias, Dr. Alberto Bollero, Dr. Beatriz Hernández

Juan de la Cierva Programme
- 2011. Dr. Paolo Perna
- 2010. Dr. Fulvio Brunetti

Technical Support Specialist Programme.
- 2011 Dr. Santiago Casado

Spanish Ministry of Education
FPU Programme. Predoctoral Grant
- 2010. Adriana Martín
- 2011. Macarena Calero

4.4.3. Internships

Carmen Palacios. *Interactions between biocompatible nanoparticles and cells by means of optical trapping.* Imperial College, London, UK.

Helene Takac. *Effect of the nanoparticle aggregation on the heating capacity of magnetic nanoparticle.* École Européenne de Chimie, Polymers et Materiaux, École Nationale Superieur D´Ingénieurs, Strasbourg

Álvaro Alonso. *Ultrasonic manipulation of proteins on lipid membranes.* Universidad Autónoma de Madrid

Yolanda Garcimartín. *Modified oligonucleotides and gold nanoparticles in nanomedicine.* Universidad Autónoma de Madrid

Paula Gregorio. *Interactions between biocompatible nanoparticles and cells by means of optical trapping.* Universidad Autónoma de Madrid

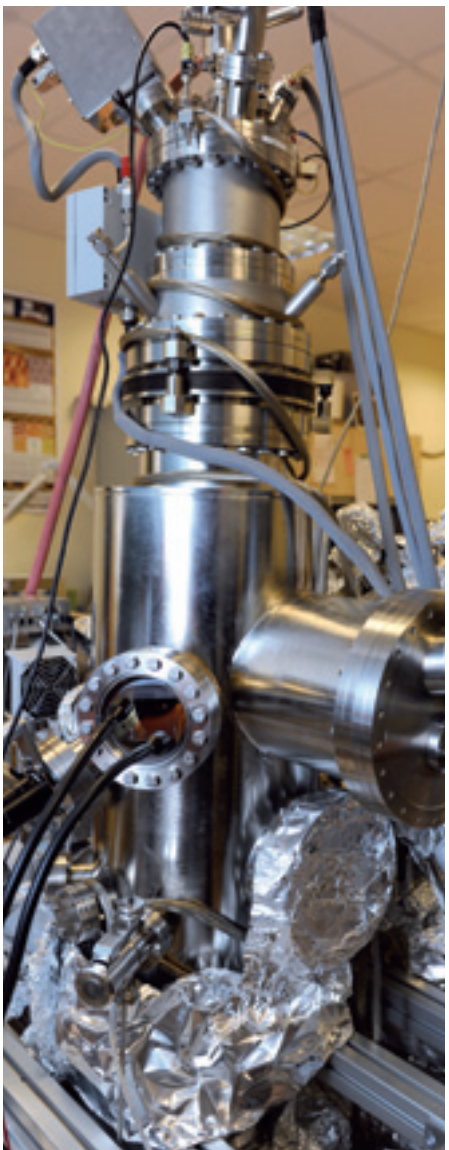
4.5. Seminars at IMDEA Nanociencia

11.01.2011

Kondo effect in atomic- and molecularsize devices from first principles Dr. David Jacob Postdoctoral Researcher Theorie-Abteilung (Prof. E.K.U. Gross) Max-Planck-Institut für Mikrostrukturphysik, Halle, Germany

24.01.2011

Ligand adsorption on iron phthalocyanine: adsorption sites, substrate decoupling, and spin state modification Dr. Joachim Schnadt Dept. of Synchrotron Radiation Research, Lund University, Sweden



14.02.2011

Nanomechanical Electron Shuttles as Nano-Antennas Dr. Robert Blick University of Wisconsin-Madison Electrical and Computer Engineering 1415 Engineering Drive Madison, WI 53706, USA

24.01.2011

Supramolecular Architectures for Artificial Photosynthesis. Prof. Stefan Matile University of Geneva Department of Organic Chemistry NCCR Chemical Biology, Geneva, Switzerland http://www.unige.ch/sciences/chiorg/matile/

02.03.2011

Atomic-scale Technologies for Monomolecular Electronics. Prof. Marek Szymonski Centre for Nanometer-Scale Science and Advanced Materials, NANOSAM Faculty of Physics, Astronomy, and Applied Computer Science, Jagiellonian University Krakow, Poland

04.04.2011

"*Red phosphorescent organic light emitting diodes based on Iridium containing complexes*", Dr. Araceli Gutierrez-Llorente, Universidad Rey Juan Carlos, Madrid Spain

17.05.2011

"*Photophysics and Application in Photonics of Supramoleculary Isolated Conjugated Polymers*", Dr. M. Mroz, Politecnico di Milano

19.05.2011

Enhanced Light Harvesting Efficiency in Dye Sensitized Solar Cells coupled to Photonic Crystals Dr. Agustín Mihi Beckman Institute for Advanced Science and Technology University of Illinois at Urbana-Champaign 405 North Mathews Avenue · Urbana, IL · 61801, USA

03.06.2011

X-ray spectroscopic investigations of adsorbed switchable molecules Prof. Wolfang Kuch Freie Universität Berlin, Institut für Experimentalphysik, Arnimallee 14, 14195 Berlin, Germany

07.06.2011

Nanoparticles in Materials and Life Sciences Prof. Horst Weller Institute of Physical Chemistry and Center for Applied Nanotechnology University of Hamburg

14.06.201

1Interfacial electron transfer on single nanoparticles Prof. Tetsuro Majima The Institute of Scientific and Industrial Research (SANKEN), Osaka University, Japan

26.08.2011

Reducing dimension of molecular magnet to single-ion level Prof. Song GAO, Beijing National Laboratory for Molecular Sciences, State Key Laboratory of Rare Earth Materials Chemistry and Applications, College of Chemistry and Molecular Engineering, Peking University, Beijing 100871, China.

29.08.2011

Structure and stability of a quinquethiophene based self-assembled monolayer

Prof. Dr. Roland Resel, Institute of Solid State Physics, Graz University of Technology, Austria

12.09.2011

Spin-polarized STM of single magnetic atoms, single organic molecules, and single magnetic nano-clusters

Prof. Toyo Kazu Yamada, Graduate School of Advanced Integration Science , Chiba University,1-33 Yayoi-chou, Inage-ku, Chiba-shi 263-8522, Chiba, Japan

20.09.2011

Synthetic organic-spin chemistry: dynamic electronic-spin nature and application of air-stable pi-extended neutral radicals

Prof. Yasushi Morita Department of Chemistry, Graduate School of Science, Osaka University, Japan

22.09.2011

Functional Nanostructures by Self-Organised Ion Beam Sputtering Prof. Francesco Buatier de Mongeot (Dipartimento di Fisica, Università di Genova)

14.10.2011

"Materiales Supramoleculares Multifuncionales", Dr. Berta Gomez-Lor, Instituto de Ciencia de Materiales

25.10.2011

Magnetic characterization of single nanostructures Prof. Hans Peter Oepen Department of Physics, University of Hamburg, Hamburg, Germany

02.11.2011

Multifunctional organic semiconductors Prof. Gianluca M. Farinola Dipartimento di Chimica, Università degli Studi di Bari Aldo Moro, Bari, Italy

02.12.2011

Single layer graphene as an electrochemical platform Prof. Héctor D. Abruña, Dept. of Chemistry & Chem. Bio. and Center for Molecular Interfacing, Baker Lab. Cornell University, Ithaca, New York

Seminars Series "Spectroscopy & Microscopy of Nanostructured Systems"

15.04.2011

Ab Initio Modelling of Donor-Acceptor Interactions and Charge-Transfer Excitations in Molecular Complexes Dr. Juan Aragó, ICMol, University of Valencia, Spain

03.05.2011

Organic Solid State Lasers Dr. María Díaz-García, University of Alicante. Spain

4.6. Honors

Best Doctoral Thesis Award in Life Science 2009-2010. Sociedad de Microscopía de España
Dr. Silvia Hormeño
2º Joint Congress of the Portuguese and Spanish Societies of Microscopy. October 2011 Aveiro Portugal

Real Sociedad Española de Física-Fundación BBVA Physics Awards
Dr. J. Ricardo Arias
Award for the best article published in Physics "*Manipulación láser de células, orgánulos y biomoléculas*"

President of the Young Chemist Researchers Specialized Group (RSEQ)
Dr. Begoña Milián replaces Dr. Juan Luis Delgado, both IMDEA Nanociencia researchers

Best 2010 Patent Award. Fundación Madrid+d
Dr. Encarnación Lorenzo
http://www.madrimasd.org/informacionidi/noticias/noticia.asp?id=50437

Best Doctoral Thesis 2011. Lorraine. France
Dr. Pierre Couleaud

honors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LA MAGIA DE IVÁN SCHULLER

4.7. Scientific Outreaching Activities

4.7.1. Talks

13.01.2011
Los avances de la Química y su impacto en la sociedad. La Química y la alta tecnología. Materiales inteligentes CSIC, Madrid, Spain. **N. Martín**

22.01.2011
Biological Nanomotors and Optical Tweezers. Master in Nanochemistry. Universidad Complutense de Madrid. **B. Ibarra**

22.01.2011
Biomolecular engineering: Protein design. Master in Biophysics, Universidad Autónoma de Madrid (Spain). Invited guest. **A. L.-Cortajarena**

05.02.2011
Una odisea de la química y de la mujer en ciencia. Universidad de La Rioja, Logroño, Spain. **Nazario Martín.**

07.02.2011
Fullerenos y otras nanoformas de Carbono. XII Escuela Nacional de Materiales Moleculares Universitat Jaume I Castellón, Spain. **N. Martín**

10.02.2011
Mechanochemical analysis of biological processes from the single-molecule point of view. Universidad Complutense, Madrid, Spain. **J. Ricardo Arias**

21-22.02.2011
Ultrasonic techniques to characterize and manipulate self-assembling nano- and microstructures. ESF PESC-Exploratory Workshop, Casa Sefarad-Israel, Madrid, Spain. **R. Wannemacher**

talks

28.02.2011-01.03.2011

Proyecto MULTIFUN, IV Conferencia Anual de las Plataformas Tecnológicas de Investigación Biomédica: Medicamentos Innovadores, Nanomedicina y Tecnología Sanitaria. Fomentando la cooperación Farma-Biotech, Madrid, Spain. **F.J. Teran**

03.03.2011

I Jornada Innovación Universitat de Valencia, Marzo de 2011, Valencia (Spain) ***Mesa Redonda*** El futuro del modelo de investigación en el marco del Plan Nacional de I+D+i. **F.J. Teran**

23.03&26.05.2011

Unveiling Physics in Biology by Optical Manipulation of Single Molecules. **Ricardo Arias**

- 23.03.2012 ICFO – The Institute of Photonic Science. Barcelona. Spain.
- 26.05.2012 4th Thermophysics Informal Seminar. Universidad de Ourense. Ourense. Spain.

01.04.2011

Excited States in Conjugated Polymer Materials ***Tutorial***. Course "Master in Materials Science", Alicante, Spain **J. Gierschner**

06.04.2011

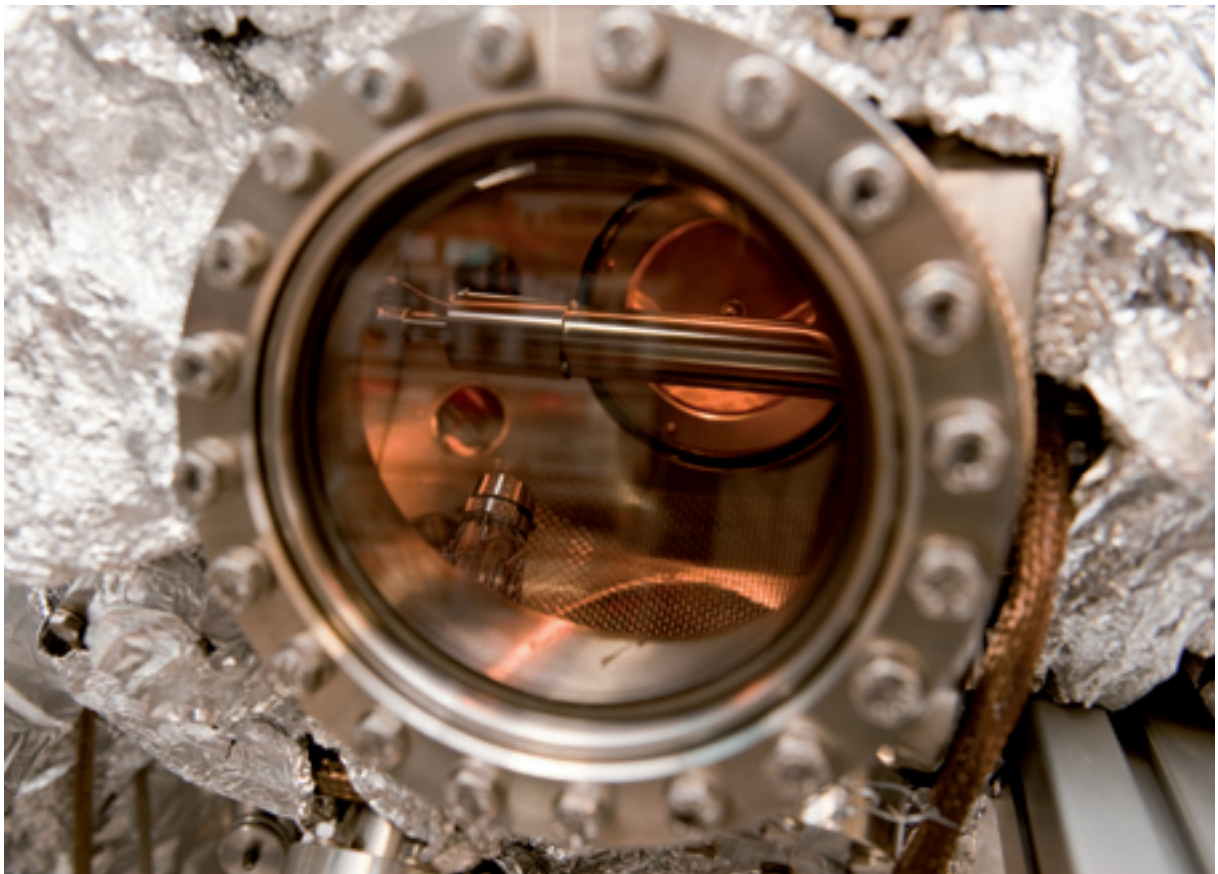
Relaciones entre estructura y propiedades nanoscópicas en sistemas virales modelo. Red Española de Biofísica de Virus. Barcelona **B. Ibarra**

06.04.2011

Designing proteins to modulate cellular networks and to generate biofunctional nanostructures Centro Nacional de Biotecnologia, Universidad Autonoma, Madrid, Spain. **A.L.-Cortajarena**

06.04.2011-08.04.2011

Relaciones entre estructura y propiedades nanoscópicas en sistemas virales modelo. Red Española de Biofísica de Virus. Barcelona, Spain. **B. Ibarra**



13.04.2011

"Cancer cell death induced by magnetic nanoparticles subjected to AC magnetic fields" Meeting 'Nanopartículas Magnéticas para Aplicaciones en Biología y Medicina', Molecular Nanoscience Consolider Network, Barbastro, Spain **F. J. Teran**

16.05.2011

Supramolecular systems based on p-extended TTF and fullerenes Universidad del Pais Vasco, San Sebastián, Spain. Emilio Pérez

26.05.2011

Preparación de grafeno por exfoliación micromecánica mediante sellos de silicona " ICMM, Madrid, Spain **N. Agraït**

27.05.2011

"Chemical and magnetic characterization of surfaces: Photoemission electron microscopy (PEEM) and low emission electron microscopy (LEEM)" Instituto de Física-Química Rocasolano, CSIC (Madrid) **Miguel Angel Niño**

11.06&19.10&28.11.2011

Nano Bio Science: Back to the renaissance man. **Ricardo Arias**

- 11-06-2011 Summer School: "Un Paseo por las Fronteras de la Ciencia" Archidona. Spain
- 19-10-2011 Meeting on frontieres in science: "Tiempo de Física".Valladolid. Spain.
- 28-11-2011.Meeting "Semana de la Ciencia". Valencia. Spain.

14.06.2011

Research lines in optical spectroscopy at IMDEA Nanociencia Instituto de Quimica Avanzada de Cataluña-CSIC, Barcelona, Spain **J. Cabanillas**

21.06.2011

"Optical manipulation of cells, organelles and biomolecules". Summer School: "Frontiers in Photonics and Laser Technologies", Santiago de Compostela, Spain. **J. Ricardo Arias**

07.07.2011

*Surface modification of magnetic nanoparticles by ligand exchange reactions.*Workshop on Magnetic Platforms ICMM-CIBERES. Madrid (Spain) **G. Hernández-Salas**

12.09.-10.10.2011

Excited States in Conjugated Organic Materials 6th International Course of the European Master in Theoretical Chemistry and Computational Modelling (EMTCCM), Valencia, Spain **J. Gierschner**

27.09.2011

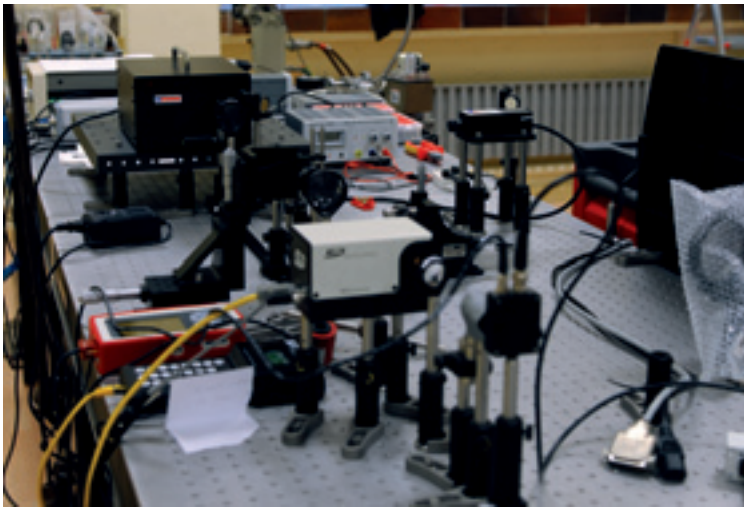
Magnetic Molecules on Graphene, Graphene Transport and Spintronics ICMM, Madrid, Spain **N. Agraït**

18.10.2011

Optical Excitations in Conjugated Molecules & Polymers: Light-Matter Interaction and Electronic Excitations , Department of Materials Science and Engineering, Seoul National University, South Korea, **J. Gierschner**

20.10.2011

Optical Excitations in Conjugated Molecules & Polymers: Vibronic Coupling and Excited State Deactivation, Department of Materials Science and Engineering, Seoul National University, South Korea, **J. Gierschner**



4.7.2. Other Outreaching Activities

Publications

28.02.2011

Madri+d

La vida después de la lámpara incandescente, **J. Gierschner & Begoña Milián**

http://www.madrimasd.org/informacionidi/noticias/noticia.asp?id=47456)

11.04.2011

El País

"¿En qué creemos?" **J. Ricardo Arias**

http://www.elpais.com/articulo/sociedad/creemos/elpepusoc/20110411elpepusoc_2/Tes

29.06.2011

Madri+d

Proyecto MultiFun: aplicación de nanopartículas al diagnóstico y tratamiento del cáncer de mama

15.07.2011

Madridiario

Nanomédicos del cáncer **F. J. Terán, A. Somoza, A. Bollero & A. L.-Cortajarena**

http://www.madridiario.es/2011/Julio/ciencia-tecnologia/noticias/205175/cancer-tratamiento-nanoparticulas-imdea.html

http://www.madridiario.es/galeria/nanotecnologia-cancer-1/49850.html
(link also in Madri+d:

http://www.madrimasd.org/noticias/proyecto-multifun—aplicacion-de-nanoparticulas-al-diagnostico-y-tratamiento-del-cancer-de-mama/49055).

29.07.2011

Diario Médico

España crece en nanomedicina ligada al cáncer **R. Miranda**

04.10.2011

Madri+d

Nanopartículas Magnéticas contra el Cáncer **A. Somoza y F. J. Terán**

http://www.madrimasd.org/informacionIdi/analisis/analisis/analisis.asp?id=49974

10.11.2011

El País

Nanopartículas inteligentes para estímulos de luz **J. Ricardo Arias, S. Hormeño & B. H. Juárez**

http://www.elpais.com/articulo/sociedad/Nanoparticulas/inteligentes/estimulos/luz/elpepusoc/20111110elpepusoc_20/Tes

Lab tours for high school students at IMDEA Nanoscience

14.10.2011

Lecture "Nanoscience and Nanotechnology: A fantastic Voyage". Colegio Virgen the Europa, Madrid, Spain. **D. Granados**

11.11.2011 & 18.11.2011

XI Semana de la Ciencia. IMDEA Nanociencia

16.11.2011

Talk and exhibition of scientific experiments for secondary school students at IES María Moliner, in Segovia (Spain), November 16, 2011. Title: "Iron Oxide Nanoparticles". **Dr. Francisco J. Terán and Dr. Gorka Salas.**

12.12.2011

Madri+d

A la búsqueda de nanosistemas inteligentes y biocompatibles **J. Ricardo Arias González, Silvia Hormeño & Beatriz H. Juárez**

http://www.madrimasd.org/informacionIdi/analisis/reportajes/reportajes.asp?id=50743

25.12.2011

El Mundo

La fuerza de la luz para estirar una sola molécula **J. Ricardo Arias**

http://www.elmundo.es/elmundo/2011/12/25/nanotecnologia/1324836364.html

27.05.2011

Instituto de Física-Química Rocasolano, CSIC, Madrid "Chemical and magnetic characterization of surfaces: Photoemission electron microscopy (PEEM) and low emission electron microscopy (LEEM)" **M.A. Niño**

5 research focus

multiFunctional

MultiFunctional Nanotechnology for Selective Detection and Treatment of Cancer

Nanomedicine is an emerging and multidisciplinary area[1] based on the progress of different scientific disciplines at the nanometer scale such as material science or cell biology. Nanomedicine has the aim of achieving personalized and more efficient biomedical applications for detecting and treating health diseases such as cancer. For that purpose, physicists, chemists, biologists, engineering and clinicians work together for addressing the new cancer solutions from different perspectives: from the fabrication and characterization of customized nanomaterials till the evaluation of the interaction with biological systems such as nucleic acids, proteins, cells or tissues. In this context, superparamagnetic iron oxide nanoparticles appear as suitable platforms to act as nanovector with different functionalities such as contrast agents, drug delivery nanocarriers, and intracellular heating inductors.

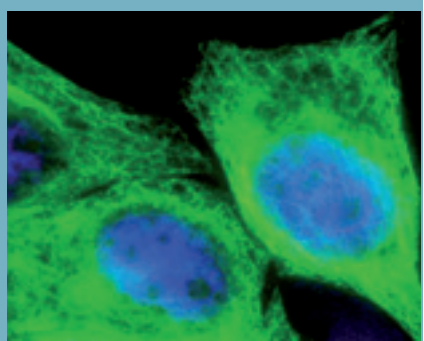
Since June 2011, ***MultiFun*** project is running for achieving the development and validation a novel and minimally-invasive nanotechnology system to improve cancer diagnosis and treatment. Funded by European Union through the Seventh Framework Program with 9.8 million euros, ***MultiFun*** consortium involves 16 research organization, universities and industrials. ***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 potential medical applications such as contrast agents, and intracellular heating generator. Moreover, MNP can be functionalised with ligands to carry anticancer agents or to increase their affinity towards cancer cells in order to facilitate drug delivery or cancer detection by imaging techniques. Thus, the ***MultiFun*** therapeutic approach combines the MNP heating power induced by the presence of alternating magnetic fields with intracellular drug delivery in order to reinforce the cancer cell elimination. Additionally, since MNP act as contrast agents, they can be used for cancer cell detection. In this way, MultiFun nanotechnology combines therapeutic and diagnostic aspects leading to novel "theragnostic" tools.

for selective detection and treatment of cancer

The objectives of ***MultiFun*** are listed below:

Scientific objectives

- Cell internalisation routes of MF-MNP.
- Evaluation of cyto-toxicity of MF- MNP *in vitro*.
- Distribution and toxicity analysis of MF-MNP *in vivo*.

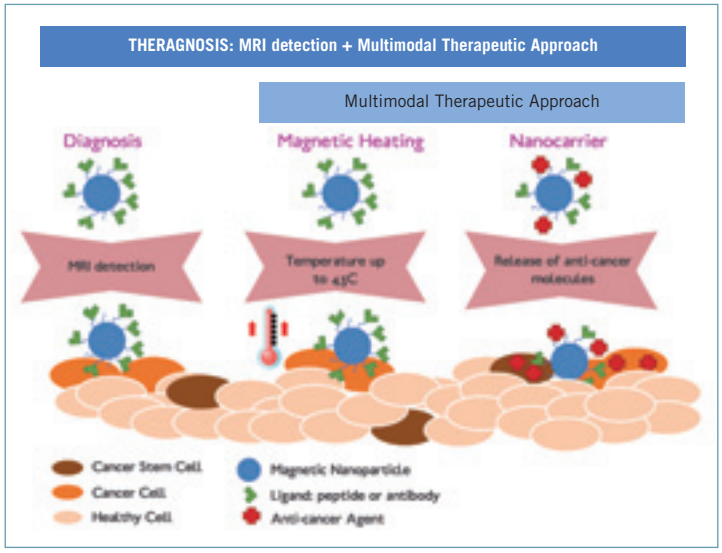


Nanotechnology

- Evaluation and validation of breast and pancreatic cancer multimodal therapeutic strategies in *in vitro* and *in vivo* models.
- Demonstration of breast and pancreatic cancer theragnosis approach at early stages throughout cancer stem cells.
- Identification of highly specific markers for breast and pancreatic cancer stem cells.

Technological objectives

- Large scale production of biocompatible MNP with optimised contrast signal and magnetic heating power.
- Multifunctionalisation of MNP for anti-cancer agent delivery.
- Development and validation of equipment for MNP detection & quantification in blood, urine and tissue samples.
- Development and validation of magnetic heating equipment for in vitro and in vivo applications.



The ***MultiFun*** consortium is integrated by a multidisciplinary panel of excellecent research groups, and innovative small, medium companies integrated in 16 european institutions. The project is coordinated from Spain where ATOS takes care on management coordination and IMDEA Nanoscience on scientific coordination.

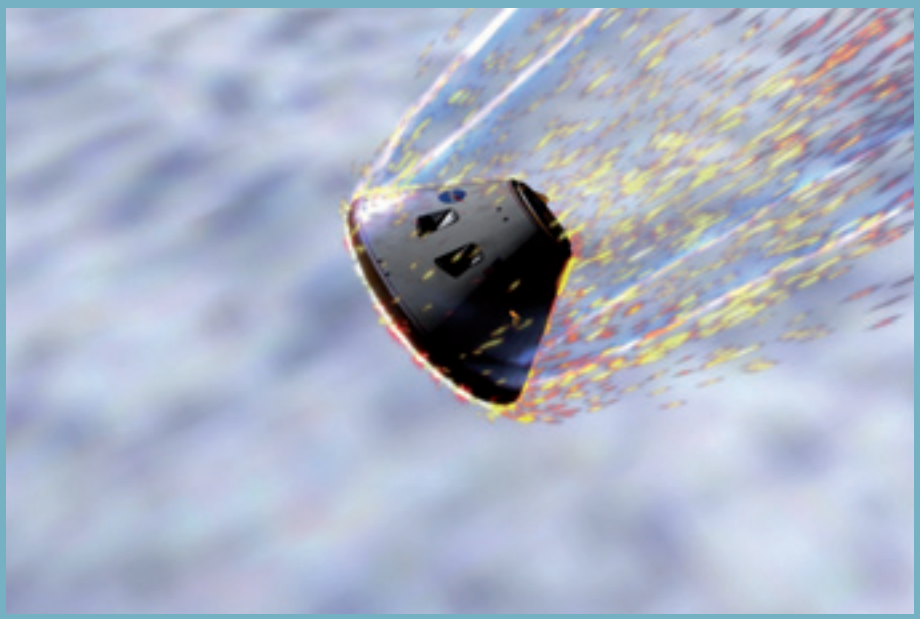
Consortium

perigeo

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



Government, and also represents an important step forward in the consolidation of the Spanish aerospace company, Elecnor Deimos, in collaboration with industrial and academic partners from the European space industry.

ELECNOR DEIMOS is leading the aerospace consortium formed by AERNNOVA, GMV, IXION, EMBENTION, AERLYPER, SCR and AD-TELECOM, among other companies, and the public research organizations INTA, UCIII, UPM and IMDEA Nanociencia among others.

The research objective of IMDEA-Nanociencia within PERIGEO´s project is to test whether it is possible to develop Graphene-based coatings to functionalize ceramic materials and composites used in the Aero-Space industries. The intent is to enhance the thermal protection of heat shields used in landing modules to dissipate the heat generated during the atmospheric entry. The proposed technology would be applicable to a wide range of missions on different planets or moons. IMDEA Nanociencia will do this work under the leadership of Aernnova, the company that leads the Innovation WP within PERIGEO.

The proposed Graphene-based coatings could significantly reduce the amount of heat generated and transmitted to the spacecraft and decrease the erosion of the shield throughout an anti-catalytic behaviour of the Graphene coating. This coating would partially annihilate the ions generated during the (re)-entry and that are mostly responsible for the degradation process of the shield materials.

IMDEA-Nanoscience will grow Graphene coatings on different ceramic and compound materials. These sample materials will be provided by AERNNOVA. After a simple characterisation of the Graphene coatings by scanning probe microscopy and optical methods, the samples will be put to the test in a plasma ion source that will simulate the atmospheric entry into the atmosphere of Titan or other planets.

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