

imdea nanoscience institute

nanoscience and nanotechnology: small is different

institute
iMdea
nanoscience

a n n u a l r e p o r t

2013

f o r e w o r d

foreword



Rodolfo Miranda

Director, IMDEA Nanoscience Institute
may 2014

annual report
2013

IMDEA Nanociencia has taken a giant step forward during 2013. With the steady support (and not only financial) from the Regional Administration we have organized in the new building more than 30 working research labs, the brand new Centre for Nanofabrication with its 200 square meters clean room that is part of the Campus of International Excellence UAM+CSIC, the mechanical workshop and the Helium liquefier and recovery system. Most of the equipment and facilities needed to carry out first class research are already available to our researchers.

Additionally, during 2013 we have set a new Research Programme on Nanomedicine, hired the first scientists for this Programme and establish a close collaboration with medical doctors to address oncological problems with a fresh approach that involve the use of magnetic nanoparticles for hyperthermia (see Research Highlight below). New patents have been granted to IMDEA Nanociencia during 2013, while the scientific production has reached more than 140 papers this year, often published in the highest impact journals (average impact factor of 5.53), with an average number of citations during 2013 of more than 2000 and an institutional h-index of 37.

Producing basic science has not been the only task of our researchers: the contracts and projects together with companies have kept the steep increase of the past years, realizing our goal of incorporating the strategic needs of companies into our research programmes. We have further developed the international presence of our Institute by establishing close relations with policy makers and research organizations from China, Marocco, Argentina, Poland and other countries.

Our researchers have received a variety of honors during 2013: Dr. J.L. Delgado received the Young Researcher Award from Lilly and the Sigma Aldrich Emerging Investigator Award, Dr. Alfonso Latorre, the Richard Smalley Award from the Electrochemical Society, Dr. Begoña Sot the “Woman in Science” prize from L’Oreal and our associate researchers Profs. Tomás Torres and José L. Carrascosa, the Gold Medal from the Royal Society of Chemistry of Spain and the National Prize from the Spanish Society of Virology, respectively.

Our best values, however, have been the enthusiasm that one can feel walking the corridors of the Institute, the forward thrust of our scientists and managers and the atmosphere of collaboration and genuine commitment. Let’s do what is needed to keep this music playing.

With my warmest thanks to all involved in IMDEA Nanociencia.

t a b l e o f
c o n t e n t s

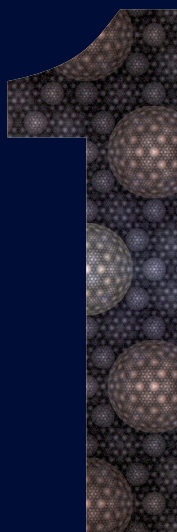
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1.1. Legal Status

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

The Foundation is governed by a Board of Trustees, which has representatives of the national and regional administration, the Academic Institutions (Complutense, Autonoma and Politecnica Universities, Consejo Superior de Investigaciones Cientificas), industries, members of the Scientific Advisory Council, and experts in societal implications of nanoscience and technology transfer.

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

1.2. Strategic Goals

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

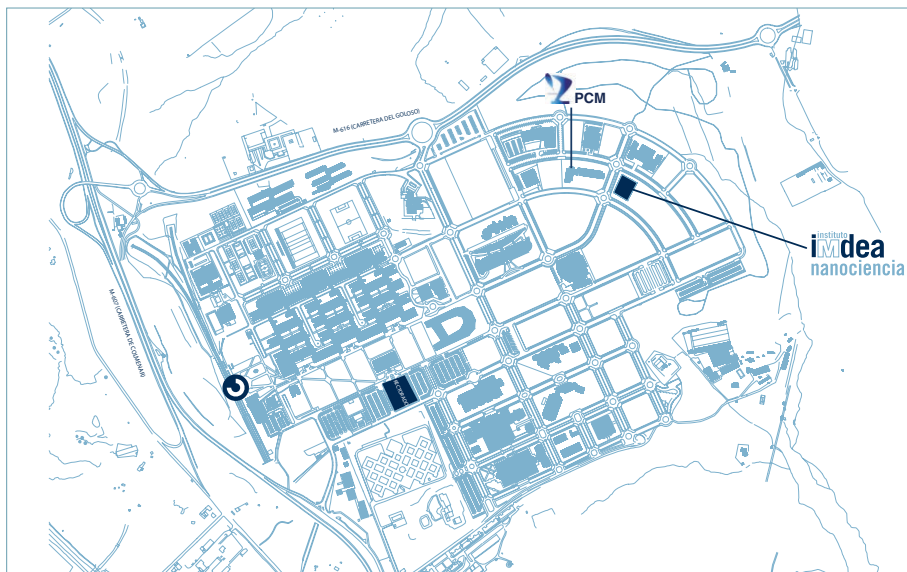
Moreover, it is essential to be able to recruit and retain new talent and to repatriate some young scientists working abroad, to train a new generation of technicians and scientists in a genuine interdisciplinary discipline, and to create and maintain new experimental equipments and advanced infrastructures.

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



1.3. Location

IMDEA Nanociencia has been located provisionally mostly in spaces from the School of Sciences of the UAM and the School of Chemistry of the UCM. The building of IMDEA Nanociencia is at the Campus of the UAM in Cantoblanco, near Madrid. Given the interdisciplinary nature of research in Nanoscience, the location of the Institute in an environment characterized by its excellence in related research areas is ideal. The foundation stone was laid on a public ceremony on January, 13th, 2010. The building was completed by December 2011 and is fully operational since June 2012. Its 8.200 m² host 44 laboratories, offices and facilities such as the Center for Nanofabrication of the Campus of International UAM+CSIC or the Center for Ultra-High Resolution Electron Microscopy.



IMDEA Nanociencia. Universidad Autónoma de Madrid. Cantoblanco Campus.

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

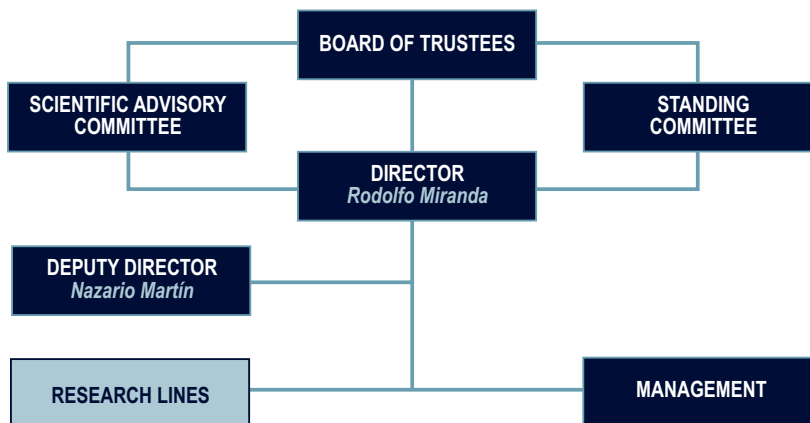
1.4. Recruitment Procedure

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.

As a result of the recruitment procedure, 81 scientists work at IMDEA Nanociencia, 11 of which are associate scientists, and 32 are paid by various competitive programmes. Currently, 30 % of the scientific staff is foreign (12 different countries), and 88% have previously worked in foreign institutions.

1.5. Management Structure



1.6. Board of Trustees

PRESIDENT OF THE FOUNDATION

Prof. Ivan Schuller

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

INSTITUTIONAL TRUSTEES

Mrs. Alicia Delibes

Vice-counselor for Education Madrid Regional Government. Spain

Mr. Jon Juaristi

*(until June 2013)
Director General of Universities and Research
Madrid Regional Government. Spain*

Mrs. Rocío Albert López-Ibor

*(since June 2013)
Director General of Universities and Research
Madrid Regional Government. Spain*

Mr. Juan Ángel Botas

*Deputy Director for Research,
Madrid Regional Government. Spain*

Mr. José de la Sota

*Managing Director
Fundación madri+d para el
Conocimiento, Madrid. Spain*

Mr. Juan María Vázquez

*General Director for Scientific and
Technical Research Ministry of
Economy and Competitiveness. Spain*

Mrs. Marina Villegas

*Vicedirector for Research
Projects Ministry of Economy and
Competitiveness. Spain*

ACADEMIC TRUSTEES

Prof. Pedro Serena

Consejo Superior de Investigaciones Científicas (CSIC). Spain

Prof. José María González-Calbet

Universidad Complutense de Madrid. Spain

Prof. Rafael Garesse

Universidad Autónoma de Madrid. Spain

Prof. Elías Muñoz

Universidad Politécnica de Madrid. Spain

SCIENTIFIC TRUSTEES

Prof. Luis Echegoyen

University of Texas at El Paso, USA

Prof. Emilio Méndez

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

Prof. Héctor Abruña

Cornell University. USA

Prof. Carlos Bustamante

Howard Hughes Medical Institute University of California, Berkeley. USA

EXPERT TRUSTEES

Mr. Jerry B. Torrance

Consultant-advisor and expert in Technology Transfer in Nanoscience. State of California and the National Nanotechnology Initiative. USA

COMPANY TRUSTEES

Ramen, S.A

*Mrs. Silvia Cristina López
Mr. Emilio Ramiro*

Tecnovac, S.A

Mr. César Atienza

Acciona

Mr. José Cubillo

GMV Aerospace and Defense SAU

Mr. Manuel Pérez



1.7. Scientific Advisory Committee

Prof. Héctor Abruña

Emile M. Chamot Professor. Cornell University. USA

Prof. Harald Brune

Director of the Institute of Nanostructures at Surfaces. Ecole Polytechnique Fédérale de Lausanne (EPFL). Switzerland

Prof. Carlos Bustamante

Howard Hughes Medical Institute. Investigator Professor of Molecular and Cell Biology Physics, and Chemistry University of California, Berkeley. USA

Prof. Luis Echegoyen

University of Texas at El Paso, USA

Prof. Andreas Engel

M.E. Müller Institute, University of Basel Switzerland & Pharmacology Case Western Reserve University. USA

Prof. Michael Graetzel

Director Laboratory for Photonics and Interfaces (LPI) Ecole Polytechnique Fédérale de Lausanne (EPFL). Switzerland

Prof. Atac Imamoglu

Institute of Quantum Electronics. ETH Zurich. Switzerland

Prof. René A. J. Janssen

Eindhoven University of Technology Molecular Materials and Nanosystems. The Netherlands

Prof. Dr. Jürgen Kirschner

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

Prof. Emilio Méndez

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

Prof. Maurizio Prato

Dipartimento di Science Farmaceutiche. Università di Trieste. Italy

Prof. Rasmita Raval

Director of Surface Science Research Centre. University of Liverpool. United Kingdom

Prof. Miquel Salmerón

Senior Staff Scientist and Principal Investigator Materials Science and Engineering Lawrence Berkeley National Laboratory

Prof. Niyazi Serdar Sariciftci

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

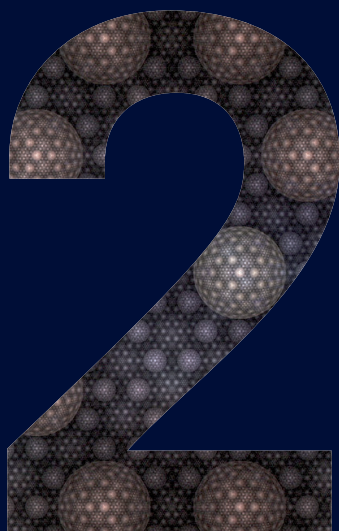
Prof. Ivan Schuller

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

research programmes and scientists



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Programme 1

Molecular Nanoscience:

- Chemical Synthesis
- Time resolved Optical Spectroscopy

Programme 2

Scanning Probe Microscopies and Surfaces

Programme 3

Nanomagnetism

Programme 4

Nanobiosystems: Biomachines and Manipulation of Macromolecules

Programme 5

Nanoelectronic and Superconductivity

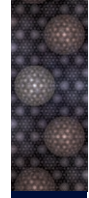
Programme 6

Nanosurfaces and nanodevices

Programme 7

Nanomedicine





programme 1

molecular nanoscience

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

Chemical synthesis

**Prof. Nazario Martín**

Programme Manager

Double Affiliation: Universidad
Complutense de Madrid, Spain

Nazario Martín (Madrid, 1956) is full professor of Organic Chemistry at the University Complutense of Madrid and vice-director of the Institute for Advanced Studies in Nanoscience of Madrid (IMDEA-Nanoscience). Recently he has been appointed as Dr. h.c. by La Havana University. Professor Martín's research interests span a range of targets with emphasis on the molecular and supramolecular chemistry of carbon nanostructures such as fullerenes, carbon nanotubes and graphenes, p-conjugated systems as molecular wires and electroactive molecules, in the context of electron transfer processes, photovoltaics applications and nanoscience. He has published over 420 papers in peer reviewed journals, given over 260 lectures in scientific meetings and research institutions, and supervised 25 theses. He has co-edited six books related with carbon nanos-

tructures and he has been invited as guest editor for eight special issues in well-known international journals. Professor Martín has been visiting professor at UCSB and UCLA (California, USA) and Angers and Strasbourg (France) universities. He has served as a member of the Editorial Board of Chemical Communications, and he has served as General Editor of the Spanish journal *Anales de Química* (2000-2005) and as a member of the International Editorial Advisory Board of The Journal of Materials Chemistry (2000-2006). He is currently the Regional Editor for Europe of the journal *Fullerenes, Nanotubes and Carbon Nanostructures* and a member of the International Advisory Board of The Journal of Organic Chemistry (ACS), *ChemSusChem* (Wiley-VCH), *ChemPlusChem* (Wiley-VCH), *Chemical Society Reviews* (RSC) and *Chemical Communications* (RSC). He is a member of the Royal Academy of Doctors of Spain as well as a fellow of The Royal Society of Chemistry. In 2006-2012 he has been the President of the Spanish Royal Society of Chemistry. He

has been the recipient of the "Dupont Prize of Science" in 2007 and of the "Gold Medal and Research Award" in 2012, the highest distinction given by the Spanish Royal Society of Chemistry. He has recently been appointed with the national "Jaime I Award for basic research" 2012. He is the last chemist distinguished with the "EuCheMS Lecture Award" in 2012.

Relevant publications

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

Supramolecular chemistry and self-assembly of functional materials

Dr. Emilio Pérez

Researcher

Ph.D.: University of Edinburgh, UK
Previous Position: Universidad Complutense de Madrid, Spain



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

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

Research lines

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

Relevant publications

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



Dr. María del Mar Bernal

Postdoc

Italian Institute of Technology (IIT) - Nanophysics Facility, Smart Materials Group Genova, ITALY

Helena Isla

(until September 2013)

Ph.D. student

Alberto de Juan

Ph.D. student

Alejandro López

Ph.D. student

Sofía Leret

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-acceptor₁-acceptor₂ 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. Ismail Hazaji

(until June 2013)

Postdoc

CEA-Saclay, Laboratory for Molecular Electronics, France

Carmen Villegas

(until July 2013)

Ph. D. student

Inés García

Ph.D. student

Rosa María Girón

Ph.D. student

Organic Functional Materials

Prof. Tomás Torres

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

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

Research lines

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

Relevant publications

- "Linking Photo- and Redox-active Phthalocyanines Covalently to Graphene" M.-E. Ragoussi, et col. *Angew. Chem. Int. Ed.* 2012, 51, 6421-6425
- "Carboxyethylnyl Anchoring Ligands: A Means to Improve the Efficiency of Phthalocyanine-Sensitized Solar Cells" M.-E. Ragoussi, et col. *Angew. Chem. Int. Ed. Eng.* 2012, 51, 4375-4378



- "Towards tunable graphene / phthalocyanine-PPV hybrid systems" Jenny Malig, et col. *Angew. Chem. Int. Ed.* 2011, 15, 3561-3565



Dr. Giovanni Bottari

Postdoc
University of Warwick (UK)



Dr. Olga Trukhina

Postdoc
Ivanovo State University of Chemistry and Technology, Russia

Hybrid systems based on semiconductor nanoparticles

Dr. Beatriz H. Juárez

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

Beatriz Hernández Juárez is associated professor at the Universidad Autónoma de Madrid (from Sep.12) and former researcher in the "Ramón y Cajal" programme at IMDEA Nanoscience. She received a B.Sc. degree in Chemistry from the Universidad Complutense de Madrid (UCM) in 1999 and a Ph.D degree in Material Sciences from the Universidad Autónoma de Madrid (UAM) in 2005 with a work on Photonic Crystals supervised by Prof. C. López. Dr. Hernández also worked for almost 2 years in Lucent Technology, a factory devoted to the fabrication of microelectronic circuits in a clean room laboratory. After finishing the PhD, she moved to the Laboratoire de Photonique Quantique et Moléculaire (LPQM) in Paris. After a short stay, she joined the group of Prof. Dr. Horst Weller in Hamburg (<http://www.chemie.uni-hamburg.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. Juárez, et col. *Nano Lett.*, 2007, 7 3564-3568
- "High Energy Photonic Bandgap in Sb₂S₃ Inverse Opals by Sulfidation Processing" B. H. Juárez, et col. *Adv. Mater.* 2002, 15, 319-323

Fabiola Iacono

(until July 2013)
Ph. D. student

Leonor de la Cueva

Ph.D. student

María Acebrón

Ph.D. student

Developing biosensors based on nanomaterials

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 Autónoma 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 Universidad Autónoma de Madrid and the coordinator of Sensor and Biosensors Group. Professor Lorenzo's research interests are focused on the development of 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.



Designed functional nanomaterials

Prof. Félix Zamora

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



Félix Zamora received his PhD from the Universidad Autónoma de Madrid (Spain) in 1994. In 1996 he worked at University of Dortmund (Germany) as a postdoctoral HCM EU fellowship. He was visiting professor at Virginia University (USA), New Castle University (UK) and National Singapore University (Singapore). From 2002, he is "Profesor Titular" at the Inorganic Chemistry Department at the Universidad Autónoma de Madrid, and associate research at IMDEA Nanoscience. His research group (www.nanomater.es) is mainly focused in the production of functional nanomaterials. He is co-author of more than 100 papers in international first line journals (including Nature Nanotech., Nature Commun., Chem. Soc. Rev., Angew. Chem., JACS, Chem. Sci., Adv. Mater., ACS Nano, ...) and member of the Editorial Board of Scientific Reports (Nature Publishing Group). He is co-founder and scientific assessor of the company Nanoinnova Technologies (spin-off UAM company, www.nanoinnova.com) a company devoted with the commercialization of nanomaterials and devices useful at the nanoscale.

Research lines

His current research is focused on the synthesis of novel nanomaterials using several strategies based on metal modified DNA, coordination and MMX polymers, and carbon based materials (graphene, CNT and carbon nitrides). His research group is pioneer in the developing of new adsorption methods of MMX and coordination polymers which are suitable for study properties at the nanoscale. They have developed

a new source of graphene alternative 2D polymers based on MOFs and COFs. The group has a large list of collaborators all over the world, and some international companies (Abengoa Res., Intel Co., Nanotech Electrónica, ...).

Relevant publications

- Intrinsic electrical conductivity of nanostructured metal-organic polymer chains F. Zamora et al. *Nature Commun.* 2013, 4, 1709-6pp.
- Solvent-induced Delamination of a Multifunctional Two Dimensional Coordination F. Zamora et al. *Polymer Adv. Matter.* 2013, 25, 2141-2146
- Electrical conductive coordination polymers. F. Zamora et al. *Chem. Soc. Rev.* 2012, 41, 115-147.

Mohammadreza Azani

PhD. student

David Rodríguez

PhD. student

Azin Hassanpour

Internship

programme 1

molecular nanoscience

Time resolved Optical Spectroscopy



Optical spectroscopy of polyconjugated materials

Prof. Johannes Gierschner

Senior Researcher

Ph.D.: University of Tübingen, Germany

Previous Position: University of Mons, Belgium

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

Research lines

JG's work integrates steady-state and time-resolved optical spectroscopy with quantum-chemical methods to achieve an in-depth understanding of the signatures and fates of excitons in organic materials for optoelectronic applications, with special focus on environmental

effects in polymers (including aggregation, disorder, temperature, etc), single crystals of structurally well-defined oligomers and supramolecular nanostructured multi-chromophore systems.

Relevant publications

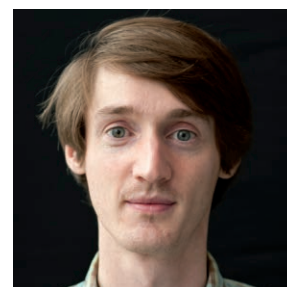
- "Luminescent Distyrylbenzenes: Tailoring Molecular Structure and Crystalline Morphology" J. Gierschner, S. Y. Park, *J. Mater. Chem. C* 1 (2013) 5818–5832.
- "Computational Engineering of Low Bandgap Copolymers" M. Wykes, B. Milán Medina, J. Gierschner, *Front. Chem.* 1 (2013) 35.
- "Highly Emissive H-Aggregates or Aggregation-Induced Emission Quenching? The Photophysics of All-Trans Para-Distyrylbenzene" J. Gierschner et al, *J. Phys. Chem. Lett.* 4 (2013) 2686-2697.



Dr. Shinto Varghese

Postdoc

National Institute for Interdisciplinary Science and Technology, Kerala, India



Dr. Mike Wykes

Postdoc

Cambridge Display Technology, UK

Shi Junqing

PhD. student

Beijing Normal University, China

Nanooptics and nanoacoustics

Prof. Reinhold Wannemacher

Senior Researcher

Ph.D.: University of Darmstadt, Germany

Previous Position: University of Leipzig, Germany

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

Research lines

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



Femtosecond spectroscopy on molecular systems

Prof. Larry Luer

Senior Researcher

Ph.D.: University of Tübingen, Germany

Previous Position: Politecnico di Milano, Italy



Relevant publications

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

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 *Rhodospseudomonas palustris*" V. Moulisova, et col. *Biophys. J.* **97**, 3019-3028 (2009)

Safakath Karuthedath

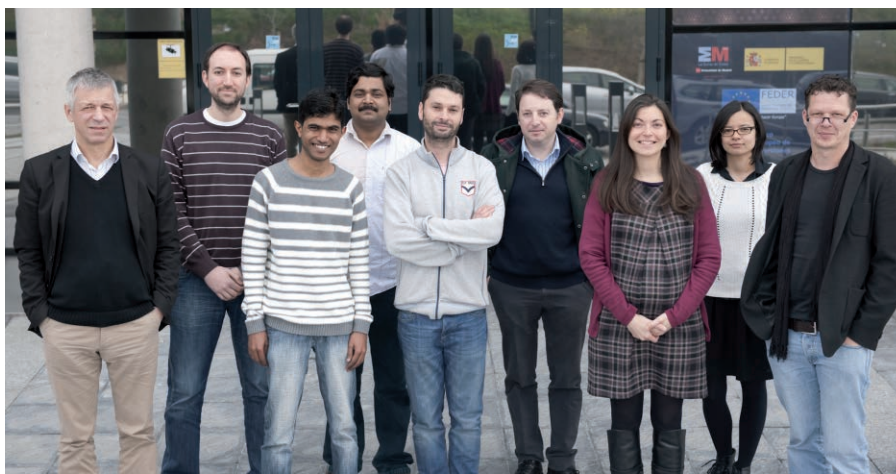
Ph.D. student

National Institute of Technology, Calicut, India

Abasi Abdulimu

Ph.D. student

Umeå University, Sweden



Pump probe and photoinduced absorption 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 π -conjugated polymer-based blends for photovoltaic applications. Between 2003-2006 he worked as post-doc at Politecnico di Milano with electric field assisted pump-probe spectroscopy. Between 2006-2009 he held a research fellowship to investigate the use of electromodulated spectroscopy coupled to confocal microscopy for charge density mapping in organic planar photodetectors. Since 2009 he is Ramon y Cajal researcher at IMDEA Nanociencia.

Research lines

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

Relevant publications

- "Role of amorphous and aggregate phases on field-induced exciton dissociation in a conjugated polymer", Marta M. Mróz et col. *Phys. Review B* 87, 035201 (2013).



- "Pump-Probe Spectroscopy in Organic Semiconductors: Monitoring Fundamental Processes of Relevance in Optoelectronics" J. Cabanillas-Gonzalez et col. *Adv. Mat.* 23, 5468 (2011).
- "Photoinduced transient stark spectroscopy in organic semiconductors: A method for charge mobility determination in the picosecond regime", J. Cabanillas-Gonzalez et col. *Phys. Rev. Lett.* 96, 106601 (2006).



Dr. Marta Magdalena Mroz

Postdoc

Politecnico di Milano, Italy

Longfei Wu

Ph.D. student

Beijing Normal University, China

Manuel Cuesta

Internship

Computational Design and Analysis of Novel π -Conjugated Materials

Dr. Begoña Milián

Researcher

Ph.D.: Universidad de Valencia, Spain

Previous Position: ICMOL, Universidad de Valencia, Valencia, Spain

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

Research lines

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



Relevant publications

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

programme 2

scanning probe microscopies and surfaces

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



Prof. Rodolfo Miranda
 Programme Manager
 Double Affiliation: Universidad
 Autónoma de Madrid, 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 post-doctoral 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 (1985)
- "Surfactant-induced Suppression of Twin Formation During Growth of fcc Co-Cu Superlattices on Cu(111)" J. Camarero, et col. *Phys. Rev. Lett.* 73, 2448, 1-6 (1994)
- "Curie Temperature of Ultrathin Films of fcc-Cobalt Epitaxially Grown on Atomically Flat Cu(100) Surface". C.M. Schneider, P. Bressler, P. Schuster, J. Kirschner, J.J. de Miguel and R. Miranda *Phys. Rev. Lett.* 64, 1059, 1-4 (1990)

Nanotribology

Prof. Enrico Gnecco

Senior Researcher

Ph.D.: University of Genova, Italy

Previous Position: University of Basel, Switzerland

Enrico Gnecco received his PhD in Physics from the University of Genova in 2001, and worked several years at the University of Basel before joining IMDEA Nanociencia in 2010. Among other topics, he investigated atomic-scale friction of metal, insulating and semiconducting surfaces in ultra-high vacuum, the onset of abrasive wear on crystal surfaces on the nanoscale, the transition from stick-slip to superlubricity, the phononic and electronic contributions to dissipation in close proximity to solid surfaces, and the confinement of organic molecules on insulating surfaces caused by artificial nanostructures. Enrico Gnecco co-authored about 70 peer-reviewed articles (including publications in Science, Nature Materials, PNAS and Nanoletters) and 4 book chapters. He also wrote the book "Nanoscale Processes on Insulating Surfaces" (World Scientific, 2009) with Marek Szymon-ski, and edited the book "Fundamentals of Friction and Wear on the Nanoscale" (Springer, 2007) with Ernst Meyer. Last but not least, he was awarded a diploma in piano from the Conservatory of Music of his hometown, Genova.

Research lines

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



Relevant Publications:

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



Dr. Pawel Nita

Postdoc

Maria Curie-Skłodowska University, Lublin, Poland

Patricia Pedraz

PhD student

Carlos Pimentel

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 as Ph.D. student 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 the Nano-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. Since January 2014 he is Senior Scientist and RyC fellow.

Research lines

My research interests are the micro and nanofabrication of electronic and photonic devices for photonics, nano-optics and quantum information processing, as well as the growth, characterisation and technologies based on graphene and other 2D materials. Recently, I have started to work on near field optical characterisation and optical Scanning tunnelling microscopy.



Relevant publications

- "Local characterization of the optical properties of annealed Au films on glass substrates" R Bernardo-Gavito et al. *J. Appl. Phys.* 114, 164312-164312-5 (2013).
- "Oscillatory persistent currents in self-assembled quantum rings" Klee-mans, 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)

Ramón Bernardo

Ph. D. Student

Fernando Jiménez

Internship

Spin-Polarized STM

Dr. Fabián Calleja

Researcher

Ph.D.: Universidad Autónoma de Madrid, Spain

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

Fabian Calleja got his Ph. D. from the Universidad Autónoma de 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 Polytechnical 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 Ángel 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 post-doctoral fellow, and after as beamline scientist, performing Photoemission Electron Microscopy and Low Energy Electron Microscopy applied to growth and characterization of magnetic thin films and nanostructures. With more than 45 publications in international journals and more than 70 communications at international congresses, he joined IMDEA Nanoscience in 2011.

Research lines

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

Relevant publications

- “Domain Wall Depinning Assisted by Pure Spin Currents” Ilgaz D, et col. *Phys. Rev. Lett.* 105, 076601,



1-4 (2010)

- “Magnetization and structure of ultrathin Fe films” R. Zdyb, et col. *Phys. Rev. B* 80, 184425, 1-9 (2009)
- “Surfactant-Assisted Epitaxial Growth and Magnetism of Fe Films on Cu(111)” M.A. Niño, et al. *J. Phys.: Condens. Matter* 20 (2008) 265008-265015



Dr. Cristina Navío

Postdoc

Mons University, Belgium

Graphene growth and spectroscopy with low-T STM

Prof. A. L. Vázquez de Parga

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

Amadeo L. Vázquez de Parga got his PhD in 1992 at the Universidad Autónoma de Madrid (UAM). Construction of a Scanning Tunneling Microscope (STM) working in ultra high vacuum, the first in Spain. He carried out a postdoc stay at IBM Research Laboratory in Rüschlikon (Switzerland) in photoluminescence excited by the STM. From 1999 Prof. Vázquez de Parga is Associate Professor in Condensed Matter Physics at the UAM and from 2008 Associated Senior Researcher at IMDEA-Nanoscience. 2002-2003 visiting researcher at the Radboud University, Nijmegen (The Netherlands), working on spin polarized STM

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

Research lines

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



Relevant publications

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



Dr. Koen Lauwaet

Postdoc
K Leuven University, Belgium

Manuela Garnica

(until September 2013)
Ph. D. student

Cosme González

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 Autónoma 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 H₂ dissociation" F. Martín et col. *Science* 315, 629-630 (2007)
- "Complete photo-induced breakup of the H₂ molecule as a probe of molecular electron correlation" W. Vanroose, et col. *Science* 310, 1787-1789 (2005)



Dr. Yang Wang

Postdoc
Universidad Autónoma de Madrid, Spain

Daniele Stradi

(until October 2013)
Ph. D. student

Theoretical Study of Molecules on Surfaces

Dr. Manuel Alcamí

Associated Senior Scientist
PhD: Universidad Autónoma de Madrid, Spain
Double Affiliation: Universidad Autónoma de Madrid, Spain



Manuel Alcamí is full Professor of Chemical Physics at the Department of Chemistry at UAM and Associated Senior Scientist at IMDEA. He graduated in Chemistry at UAM in 1987 and received his PhD in Quantum Chemistry in 1990. He did a postdoctoral stage (1991-1993) at the University of Newcastle upon Tyne (UK).

He is the national coordinator of the inter university master and doctorate programmes in Theoretical Chemistry and Computational Modelling (www.emtccm.org) and the chair of the COST Action CM1204 XLIC: XUV/X-ray light and fast ions for ultrafast chemistry (www.xlic.eu)

Research lines

His field of expertise is the theoretical study of molecules both in gas phase and deposited on surfaces. His current research lines are:

- Theoretical study of self-assembly and charge transfer processes of molecules deposited on surfaces.
- Carbon nanostructures: fullerenes, fullerene metal derivatives and graphene.
- Fragmentation and stability of highly charged and highly excited molecules.

Relevant Publications

- Ultrafast Damage Following Radiation-Induced Oxidation of Uracil in Aqueous Solution P. López-Tarifa, M.-P. Gaigeot, R. Vuilleumier, I. Tavernelli, M. Alcamí, F. Martín, M.A. Herve du Penhoat and M.-F. Politis.

Angew. Chem. Int. Ed. **52**, 3160-3163 (2013)

- Response of Graphene Nanodomains S. Koch, D. Stradi, E. Gnecco, S. Barja, S. Kawai, C. Díaz, M. Alcamí, F. Martín, A.L. Vázquez de Parga, R. Miranda, T. Glatzel and E. Meyer. *Elastic ACS Nano* **7**, 2927-2934 (2013)
- Formations of dumb-bell C118 and C119 inside clusters of C60-molecules by collisions with α particles H. Zettergren, P. Rousseau, Y. Wang, F. Seitz, T. Chen, M. Gatchell, J. D. Alexander, M. H. Stockett, J. Ranganama, J. Y. Chesnel, M. Capron, J. C. Pouilly, A. Domaracka, A. Méry, S. Macloot, H. T. Schmidt, L. Adoui, M. Alcamí, A. G. G. M. Tielens, F. Martín, B. A. Huber and H. Cederquist. *Phys. Rev Lett.* **110**, 185501 (2013)
- Long-range magnetic order in a purely organic 2D layer adsorbed on epitaxial graphene. M. Garnica, D. Stradi, S. Barja, F. Calleja, C. Díaz, M. Alcamí, N. Martín, A.L. Vázquez de Parga, F. Martín and R. Miranda. *Nature Physics* **9**, 368-374 (2013)
- Charge Transfer-Assisted self-limited Decyanation Reaction of TCNQ-type Electron Acceptors on Cu(100) C. Urban, Y. Wang, J. Rodríguez Fernández, R. García, M.A. Herranz, M. Alcamí, N. Martín, F. Martín, J. M. Gallego, R. Otero and R. Miranda. *Chem. Comm.* **50**, 833-835 (2014)

Atomic and molecular self-assembly at surfaces

Dr. Roberto Otero

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



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

Research lines

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

Relevant publications

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

Fabiola Iacono
(until July 2013)
Ph. D. student

Alberto Martín
Internship

Physics of surfaces and thin films

Prof. José María Gallego

Associated Scientist

Ph.D.: Universidad Autónoma de Madrid, Spain

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

José María Gallego received his B.S. degree in physics from the Universidad Autónoma de Madrid in 1986 and completed his Ph.D. in 1991 with Prof. Rodolfo Miranda. He continued his postdoctoral 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.

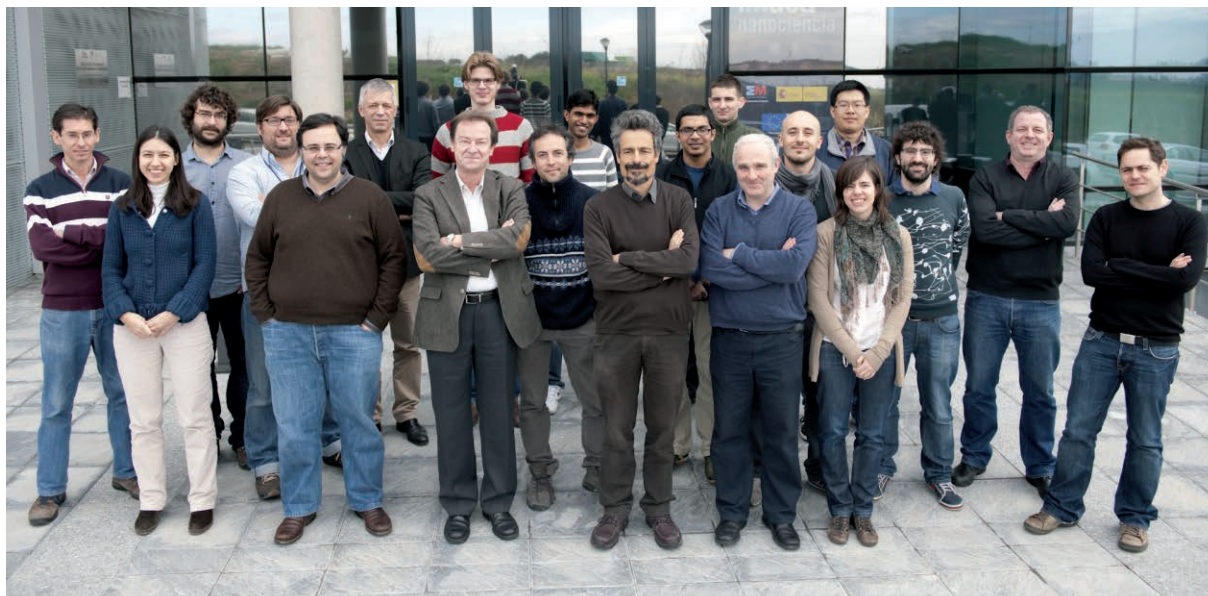
Research lines

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)



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

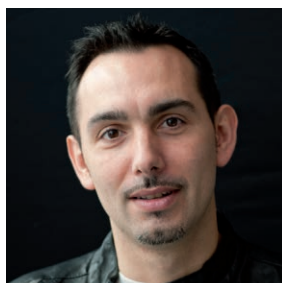
- **Magnetic nanostructures for spintronics.** Miniaturization of magnetic multilayered devices for technological applications in magnetic sensors based on spin valves and magnetic tunnel junctions. Magnetization reversal mechanisms and thermal stability.
- **Magnetic nanoparticles with biomedical applications.**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

Postdoc

Universidad de Oviedo, Spain

José Luis Fernández

Ph. D. student

Francisco Javier Pedrosa

Ph. D. student

Eider Bergara

(until November 2013)

Ph. D. student

Growth & nanostructuring. magneto-electric thin films

Dr. Feng Luo

Researcher

Ph.D.: Peking University, China

Previous Position: Peking University, China

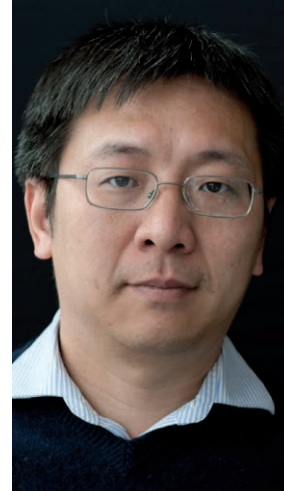
Feng Luo got his PhD in Materials Chemistry at the College of Chemistry and Molecular Engineering, Peking University in 2004. Then he worked as a postdoc in the Max-Planck-Institute for Microstructure Physics (Germany) and in the Laboratory for Micro- and Nanotechnology from the Paul Scherrer Institut (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 magnetoelectric 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-INFN CRS Coherencia, Naples, Italy

Davide Maccariello

Ph. D. student

Hauyu Feng

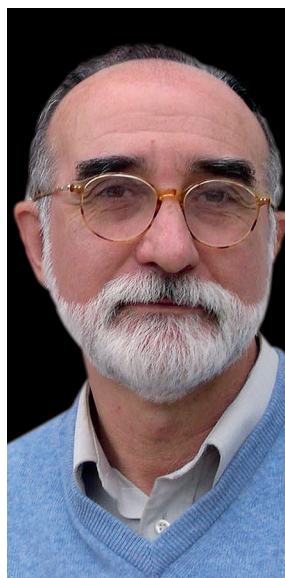
Ph. D. student

Beijing Normal University, China

programme 4

nanobiosystems: biomachines and manipulation of macromolecules

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



Prof. José L. Carrascosa

Programme Manager

Double Affiliation: Centro Nacional de Biotecnología CNB-CSIC, Spain

Prof. Carrascosa is Research Professor of the CSIC and Director of the Department of Structure of Macromolecules at the Centro Nacional de Biotecnología. He has been involved in the development of advanced microscopy methods for the structural analysis of biological material, with special emphasis in the study of different viral model systems. His activity has produced near 200 publications with an H index of 40.

Prof. Carrascosa has carried out an extended international activity: President of the European Microscopy Society (2000-2004), member of the Executive Committee of the International

Federation of Microscopy Societies (2010-2014), member of the Scientific Advisory Board of the European Synchrotron Radiation Facility (1995-1996; 2003-2005; 2006-2008), and Chairman of the Scientific Advisory Committee of ERA-Instruments (2008-2011), among others. He has been President of the Spanish Biophysical Society (2003-2007) and President of the Spanish Society of Cell Biology (1993-1996). Prof. Carrascosa is member of the editorial boards of the Journal of Structural Biology and Micron.

Relevant publications

- The structure of CCT-Hsc70(NBD) suggests a mechanism for Hsp70 delivery of substrates to the chaperonin Cuellar, J., Martín-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)

Optical nanomanipulation in molecular and cell biophysics

Dr. Ricardo Arias-González

Researcher

Ph.D.: Universidad Complutense
de Madrid, Spain

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

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

Research lines

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



Relevant publications

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

Irene Gutiérrez

PhD. student

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

Research lines

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

Relevant publications

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

José Alberto Morín

(until September 2013)
PhD student

Fernando Cerrón

Internship

Super resolution Fluorescence Microscopy

Dr. Cristina Flors Ong

Researcher

PhD.: Institut Químic de Sarrià, Spain

Previous Position: University of Edinburgh, Edinburgh, UK



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

Research lines

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

therapy or electron microscopy.

Relevant publications

- “Correlative atomic force microscopy and localization-based super-resolution microscopy: revealing labelling and image reconstruction artefacts A. Monserrate, S. Casado, C. Flors *ChemPhysChem*, 2014, DOI: 10.1002/cphc.201300853
- Super-resolution fluorescence imaging of directly labelled DNA: from microscopy standards to living cells, C. Flors *J. Microsc.* 251 (1), 1-4, 2013
- Singlet Oxygen Generation by the Genetically Encoded Tag miniSOG R. Ruiz-González, A. L. Cortajarena, S. H. Mejias, M. Agut, S. Nonell, C. Flors *J. Am. Chem. Soc.* 135, 9564-9567, 2013.

Aitor Monserrate

PhD student

Pedro Lara

Internship

Proteins as tools in nanotechnology

Dr. Begoña Sot

Researcher

PhD.: Universidad del País Vasco, Spain

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



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

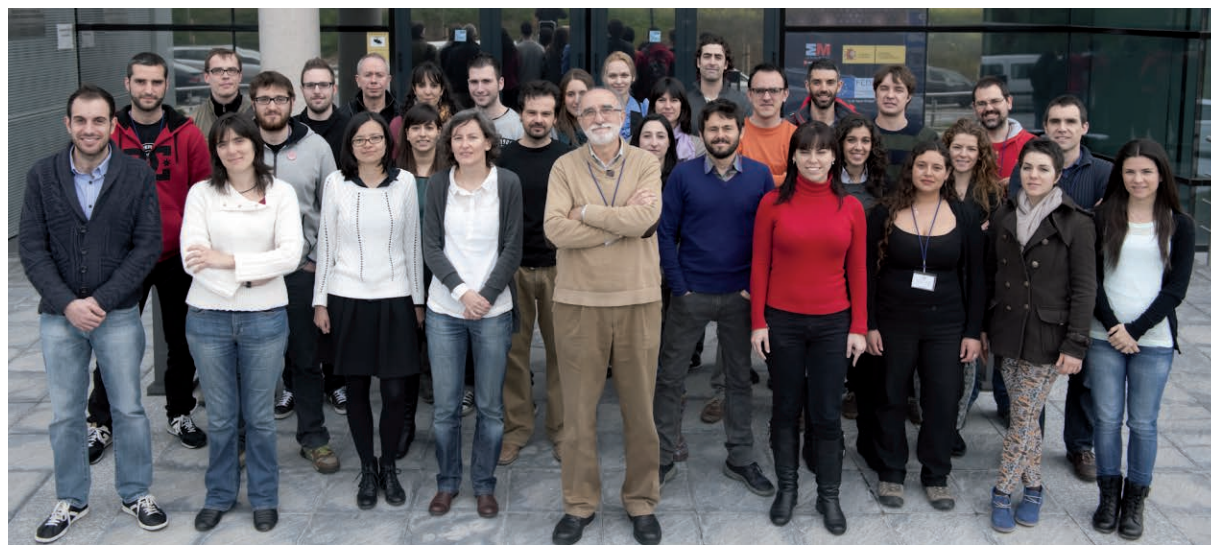
Research lines

Use of proteins as tools in nanotechnology, specifically, protein engineering approaches for the design of new recognition modules and the development of nano-reactors with improved

catalytic properties based on enzyme immobilization and co-localization.

Relevant publications

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



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 Fisica de Materiales (Universidad Complutense, Madrid) and Director of the Physical Techniques Center for Research Support (CAI Técnicas Fisicas) 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 Superconduc-

tivity and Magnetism, for instance low dimensional superconductivity, superlattices, magnetic metallic glasses, fabrication of magnetic and superconducting nanostructures, high temperature superconductivity, nanomagnetism, superconducting vortex physics, and hybrid magnetic/superconducting nanostructures.

Relevant publications

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

Electrical conductivity of single molecules

Dr. Teresa González

Researcher

Ph.D. Universidad de Santiago de Compostela, Spain

Previous Position: University of Basel, Switzerland

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

Research lines

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



Relevant publications

- “Molecular junctions based on aromatic coupling” M. T. González, et col. *Nature Nanotechnology* 3, 569-574 (2008)
- “Electrical conductance of molecular junctions by a robust statistical analysis” M. T. González, et col. *Nano Lett.* 2006, 6, 2238 -2242
- “Enhancement of J_c 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

Laura Rincón

Internship

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



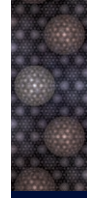
Relevant publications

- “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)

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-INFN 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.



Electrical transport in nanosystems

Prof. Nicolás Agraït

Associated Senior Scientist

Ph.D: UNED, Spain

Double Affiliation: Universidad
Autónoma de Madrid, Spain



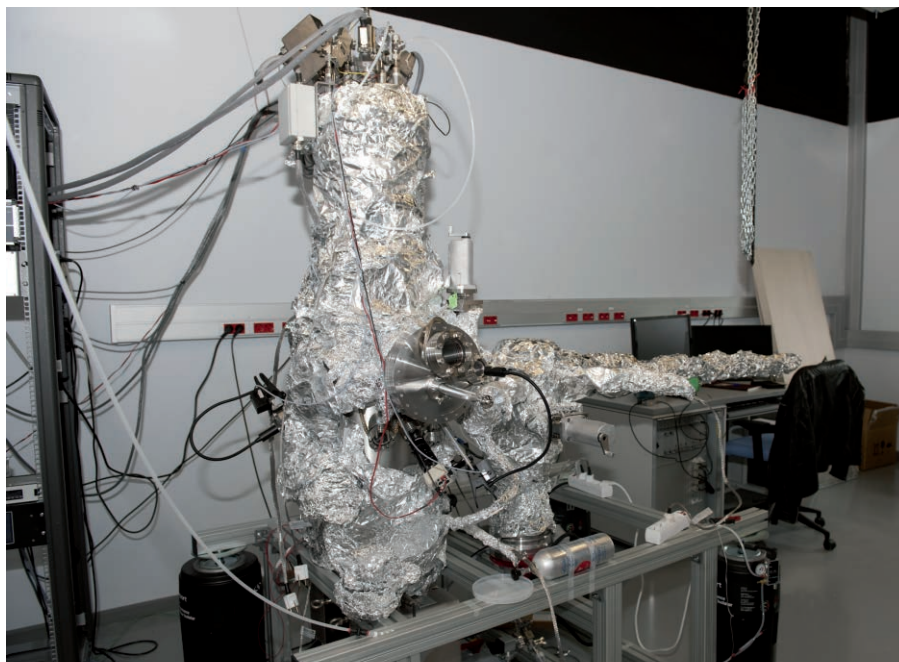
Nicolás Agraït got a Ph. D. in Physics from the UNED. He is Full Professor since 2007 at the Condensed Matter Physics Department of the UAM and Senior Associated Researcher at IMDEA-nanoscience. He is well-known for his pioneering work in quantum transport and forces in atomic-sized contacts and atomic 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. Agraït 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)



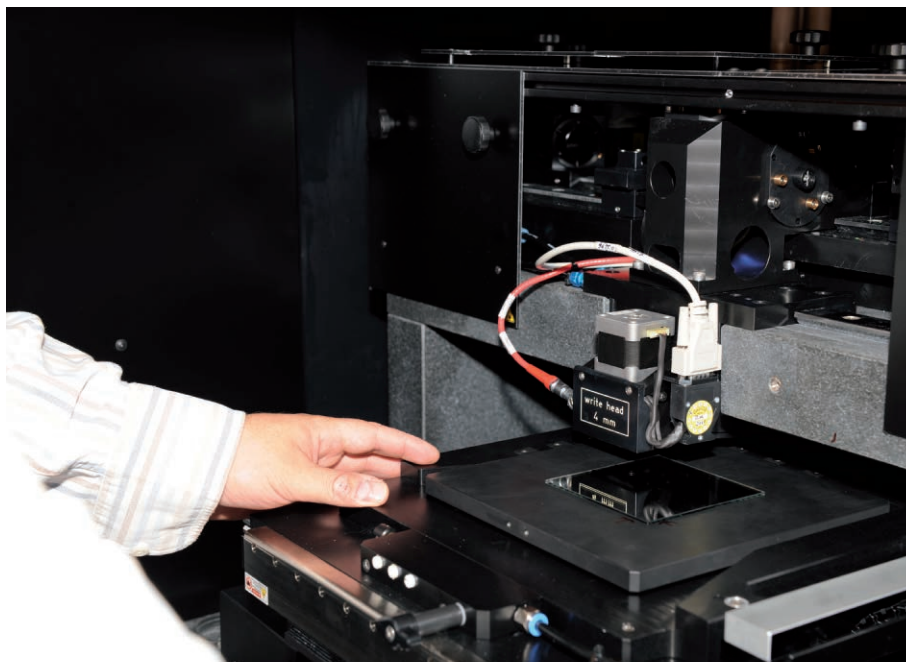
programme 6

nanosurfaces and nanodevices

This program aims at developing nano-fabrication techniques and addresses new challenges in materials processing, device design and integration, opening up in this way new opportunities for applications in areas such as biomedical technology, photonics, clean energy, water management or construction.

The program leverages on nanofabrication technologies and specially focuses on cost-effective scalable process to develop new surface structured materials, to add new functionalities, or to improve those of existing materials. The special competencies within the program include surface patterning techniques such as nano-imprint lithography, soft lithography, block copolymer lithography and patterning of molecular grafts.

Particular attention is presently directed towards the development of surfaces with self-cleaning or antibacterial functionalities. In the area of photonics the properties of nano-imprinted light-emitting structures are under investigation. Another area of research focuses on the development of microfluidics devices including integrated SERS sensors and bacteria arrays for toxicology tests.



Center for Nanofabrication



Dr. Daniel Granados

Director of the Center for
Nanofabrication

Dr Daniel Granados joined IMDEA Nanoscience in September 2009. Since his arrival he has been in charge of the design and supervision of the construction works of the clean room that hosts the Centre of Nanofabrication. He has also been in charge of the acquisition and installation of the nanofabrication tools. Dr. Granados is currently the Director of the Centre of Nanofabrication. His expertise in micro and nanofabrication focuses on photonics and nano-optics devices. Recently he has started to fabricate electro-optical prototypes based on graphene and other 2D materials.



Dr. David Pérez de Lara

Researcher

Dr. David Pérez de Lara joined IMDEA Nanoscience in January 2010. Since his arrival he has been part of the micro and nanofabrication researchers' team. He contributed to the installation of the optical and electronic lithography equipments. His expertise in micro and nanofabrication focuses on superconducting-magnetic hybrid electronic devices based on a controlled and directional vortex motion superconducting detectors and superconducting Josephson junctions.



Dr. Manuel Rodríguez

Research Staff
Ph. D. Universidad Autonoma
de Madrid, Spain



Micro and Nanoscale Fluidic systems

Dr. Isabel Rodríguez

Senior Researcher

PhD: National University of Singapore

Previous Position: Institute of Materials Research and Engineering (IMRE)

Isabel Rodriguez graduated in Pharmacy from the University of Alcalá de Henares and received a PhD in Science from the National University of Singapore in 1999. After her PhD, she worked at the Institute of Materials Research and Engineering (IMRE), A*STAR, Singapore where she became a senior member of IMRE's Patterning and Fabrication Group and led a number of research projects funded by both the public and private sectors. In 2013 she joined IMDEA-Nanoscience as a Senior Researcher and currently she works in areas related to the application of micro and nano fabrication technologies on polymeric materials to construct functional surfaces for the control of interfacial interactions, cell adhesion and sensing.

Research lines

Micro and nano fabrication of soft materials and applications in miniaturized (bio)analytical systems, lab-on-chip devices, micro- and nano-scale platforms for single-cell manipulation and surfaces for biomedical applications.

Relevant publications

- Microfluidic cell trap array for controlled positioning of single cells on adhesive micropatterns Lin, Laiyi; Chu, Yeh-Shiu; Thierry, Jean Paul; Lim, Chwee Teck; Rodríguez, Isabel. *Lab on a Chip*, 13, 714-721 (2013).
- Fabrication and Analysis of Gecko-Inspired Hierarchical Polymer Nanoscale. Ho, Audrey Yoke Yee; Yeo, Lip Pin; Lam, Yee Cheong; Rodríguez Isabel. *ACS NANO*, 5, 1897-1906 (2011).
- The effect of topography of polymer



surfaces on platelet adhesion. Li Buay Koh, Isabel Rodriguez, Subbu S. Venkatraman. *Biomaterials*, 31, 1533-1545 (2010).

- Capacitively coupled contactless conductivity detection with dual top-bottom cell configuration for microchip electrophoresis : Mahabadi, Kambiz A.; Rodríguez, Isabel; Lim, Chee Y.; Maurya, Devendra K; Hauser, Peter C; de Rooij, Nico F. *Electrophoresis*, 31, 1063-1070 (2010).

Relevant patents

- Super-Hydrophobic Hierarchical Structures, Method of Forming Them And Medical Devices Incorporating Them. *US pat Application no: No. 13/441,496. Filing date: April 6, 2012*
- Super-Hydrophilic Structures. *US pat Application no: No. 13/435544. Filing date: March 30, 2012*
- High aspect ratio adhesive structure and a method of forming the same *PCT/SG2010/000056, US 2011/0300339 A1. Filing date: 12 Feb 2010*
- A Substrate Having a Surface for Inhibiting Adhesion of a Target Cell Thereon and a Method of Preparing the Same, *PCT patent application, PCT/SG2009/000354. Filing Date: 24-Sep-09*

Felipe Viela

PhD student

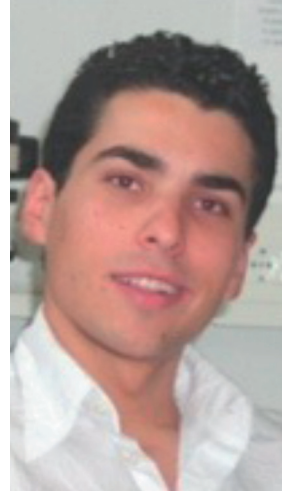
Soft Robotics

Dr. Ramses V. Martínez

PhD: Universidad Autónoma de

Madrid, Spain

Previous Position: Harvard University, USA



Dr. Ramsés V. Martínez obtained Bachelor's and Master's degrees in Physics at the Autonomous University of Madrid (UAM). In both cases he wrote a thesis on novel nanofabrication techniques under the supervision of Prof. Ricardo García. During the last year of his PhD, he spent 3 months at the Department of Material Science and Engineering at Massachusetts Institute of Technology (MIT), participating in the activities of Prof. Stellacci's research team. He has recently received a joint European doctoral degree in Physics from the Autonomous University of Madrid and the European Commission. He currently holds a three-year International Outgoing Fellowship (IOF) at Harvard University-IMDEA Nanociencia and works in the Whitesides' research group (Nanofabrication Team).

Relevant publications

- Rapid Fabrication of Pressure-driven Open-Channel Microfluidic Devices in Omniphobic RF Paper. Ana C. Glavan, Ramses V. Martinez, E. Jane Maxwell, Anand B. Subramaniam, Rui M.D. Nunes, Siowling Soh, and George M. Whitesides. *Lab on a Chip* 13, 2922-2930 (2013).
- Separation of Nanoparticles in Aqueous Multiphase Systems through Centrifugation. Ozge Akbulut, Charles R. Mace, Ramses V. Martinez, Ashok A. Kumar, Zhihong Nie, Matthew R. Patton, and George M. Whitesides. *Nano Letters* 12, 4060-4064 (2012).
- Elastomeric Origami: Programmable Paper-Elastomer Composites as Pneumatic Actuators. Ramses V. Martinez, Carina R. Fish, Xin Chen, and George M. Whitesides. *Adv. Funct. Mater.* 2012, 22, 1376-1384.

programme 7

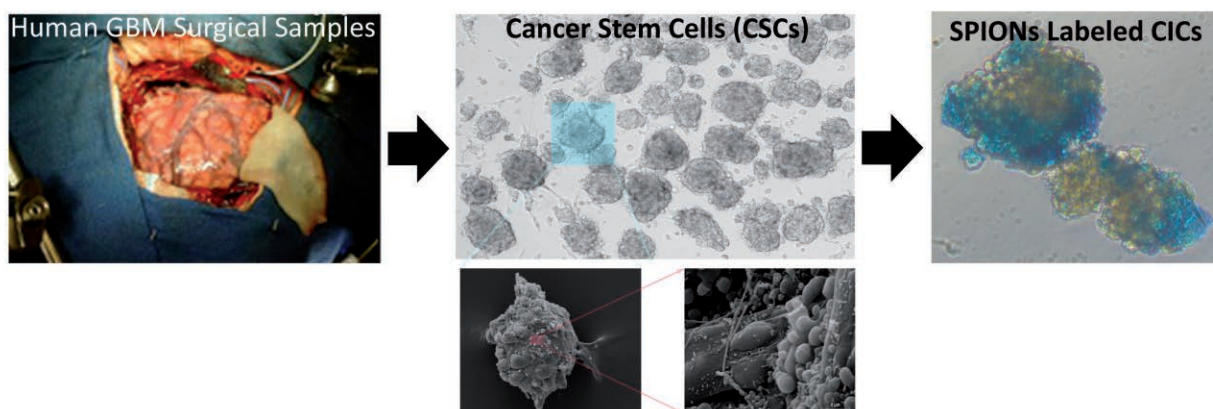
nanomedicine

This Programme deals with the development of novel nanotechnologies for medical applications that will result in better, more efficient, and cost-effective therapeutic and diagnostic tools.

One of the important areas in this Programme is the preparation and use of magnetic nanoparticles in medicine, in particular for cancer treatment and diagnosis. Magnetic nanoparticles with optimized properties are used as powerful and minimally-invasive theranostic tools. Multifunctionalized magnetic nanoparticles selectively target tumors for multimodal treatment as drug nanocarriers and heating inductors, and sensitive imaging as contrast agents. This Programme is highly interdisciplinary, combining the wide range of expertises necessary to successfully develop this research from the nanoparticle synthesis to the pre-clinical applications.

Other area of interest is the use of nanotechnology-based solutions to the growing problem of antibiotic-resistant bacteria. Nanostructures with antibacterial properties that rely on different antibacterial mechanisms are being investigated as promising alternatives to antibiotics. Antibacterial and selective bacterial entrapping nanostructured surfaces are also under development.

The generation of sensors based on nanoparticles for detection of targets of medical interest is another area under study that aims to exploit the promise to offer higher sensitivity and specificity of the nanostructure-based diagnostics platforms.



Engineering 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 Prof. 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, working on single molecule spectroscopy. Then, continued her work at Yale University, as an Associate Research Scientist with Prof. Regan. She joined IMDEA Nanociencia as Group Leader in January 2010. Her research focuses on protein design toward the application of novel protein-based nanostructures in nanotechnology, and on the generation of biofunctional nanostructures and platforms and their applications in nanomedicine

Research lines

- Bio-functionalization of magnetic nanoparticles for cancer treatment and diagnosis
- Polymer surface bio-functionalization for biosensors applications
- Protein Engineering and Biofunctional Nanostructures
- Self-assembly of designed proteins into ordered nanostructures and biomaterials

Relevant publications

- “Honeycomb patterned surfaces functionalized with polypeptide sequences for recognition and selective bacterial adhesion” A.Sanz de León, J. Rodríguez-Hernández, and A.L. Cortajarena. *Biomaterials* 34(5):1453-60 (2013)
- “Nanostructured functional films from engineered repeat proteins” T.Z. Grove, L. Regan, A.L. Cortajarena. *J R Soc Interface*. 10(83):20130051 (2013)
- “Designed proteins to modulate cellular networks” A.L. Cortajarena, Ti.Y. Liu, M. Hochstrasser, and L. Regan *ACS Chemical Biology*, 5: 545-552 (2010)



Dr. Pierre Couleaud

PostDoc

CNRS Nancy University, France

Sara H. Mejías

Ph.D. student

Magnetic nanoparticles in biomedical applications

Dr. Francisco Terán

Researcher

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

Previous Position: Centro Tecnológico 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 Joseph Fourier in 2001. Dr. Terán has performed research studies on spin and electronic properties of semiconductor nanostructures at different international research centers and joined the Nanomagnetism Programme of IMDEA Nanoscience on April 2009. Since then, Dr. Terán is interested on the dynamical magnetic properties of iron oxide nanoparticles for biomedical applications.

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

Research lines

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

Relevant Publications

- “Controlled synthesis of uniform magnetite nanocrystals with high-quality properties for biomedical applications” G. Salas, et al. *J. Mater.Chem.* 22, 21065 (2012)
- “Accurate determination of the specific absorption rate in superparamagnetic nanoparticles under non-adiabatic conditions” F.J. Terán, et al. *Appl. Phys. Lett.* 101, 062413 (2012)

- “Collective character of spin excitations in a system of Mn²⁺ ions coupled to a two-dimensional electron gas” F.J.Terán, et al. *Phys. Rev. Lett.* 91, 077201, 1-4 (2003)



Dr. Sandra Milena Ocampo

Postdoc

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Noemi García

Ph. D. student

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)



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Universidad Autónoma de Madrid, Spain

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Romina Lorca

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Sergio Adán

Internship

Synthesis of Magnetic Nanoparticles

Dr. Gorka Salas-Hernández

Researcher

Ph.D.: Universidad de Valladolid, Spain.

Previous Position: Laboratoire de Chimie Organométallique de Surface (CNRS), Lyon, France.

Gorka Salas obtained his PhD in Chemistry (2007) at the Universidad de Valladolid, under the supervision of Prof. Pablo Espinet and Juan A. Casares, working on the field of transition metal organometallic compounds and homogeneous catalysis. Then he joined the group of Bruno Chaudret and Karine Philippot at the Laboratoire de Chimie de Coordination (CNRS), in Toulouse, to work in the synthesis and application in catalysis of metal nanoparticles in ionic liquids. This work continued in the group of Catherine C. Santini in Lyon (Laboratoire de Chimie Organométallique de Surface, CNRS). Since 2011 he works at IMDEA Nanociencia in the synthesis of metal oxide nanoparticles for biomedical applications, in close collaboration with the group of M. P. Morales (Instituto de Ciencia de Materiales de Madrid, CSIC).

Research lines

- Synthesis of magnetic nanoparticles with relevant properties for different applications, with special focus in biomedicine (as magnetic hyperthermia mediators, drug carriers and contrast agents for imaging). Nanoparticles are mainly based on iron oxides, although hybrid nanomaterials combining other transition metals are under research at the lab.
- Surface modification of the nanoparticles with functional molecules for different purposes. This research is mainly focused in the use of different coatings that provide biocompatibility and functionality to the nanoparticles and allow them to be used in biomedical applications.



Relevant Publications

- "Controlled synthesis of uniform magnetite nanocrystals with high-quality properties for biomedical applications" Salas, G., et col. J. Mater. Chem. 22, 21065-21075 (2012)
- "Influence of amines on the size control of in situ synthesized ruthenium nanoparticles in imidazolium ionic liquids" Salas, G., et col. Dalton Trans. 40, 4660-4668 (2011)
- "Insights into the mechanism of the Negishi reaction: ZnRX reagents versus ZnR₂" Casares, J. A., et col. J. Am. Chem. Soc. 129, 3508-3509 (2007)

Magnetic nanoparticles in biomedical applications

Dr. Daniel Ortega

Researcher

Ph.D.: University of Cádiz, Spain
Previous Position: University College London, United Kingdom



Daniel Ortega received both MSc and PhD degrees in 2003 and 2007 at the University of Cádiz, where he successfully developed transparent magnetic nanocomposites with application in magneto-optical sensors. He undertook his first postdoctoral position at the University of the Basque Country in 2008 researching unusual magnetic properties in metallic and diluted magnetic semiconductor nanoparticles. Starting in 2009, he joined the The Royal Institution of Great Britain and the Physics department at University College London, first as a Marie Curie postdoctoral fellow and thereafter as a research associate, to work in the field of healthcare biomagnetics. During this period he was awarded an honorary research associate position at the London Centre for Nanotechnology. He is focused in bespoke magnetic nanoparticles with applications in biomedicine and developing new instrumental methods for their characterisation. Working on the same topics, he was appointed to the Toyohashi University of Technology in 2013 for a short spell. Since late 2013 he joined IMDEA Nanoscience, also holding an honorary position at the UCL Institute of Biomedical Engineering.

Research lines

- Magnetic nanostructures for magnetic hyperthermia, tissue engineering and cell therapies.
- Nanoscopy techniques for magnetically modified cells and biological constructs.
- Next-generation magnetocaloric materials.

Relevant Publications

- Magnetic hyperthermia Ortega, D.; Pankhurst, Q. A.. In *Nanoscience: Volume 1: Nanostructures through Chemistry*, O'Brien, P., Ed. *Royal Society of Chemistry: Cambridge*, 2012; Vol. 1, pp 60-88.
- Superparamagnetic iron oxide nanoparticle targeting of MSCs in vascular injury Riegler, J. et al., *Biomaterials* 2013, 34, 1987-1994.
- Rapid magnetic cell delivery for large tubular bioengineered constructs Gonzalez-Molina, J. et al., *J. R. Soc. Interface*. 2012 6, 3008-3016.

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

Macarena Calero

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Dr. Antonio Aires
Ph. D. Universidad Autónoma de Madrid, Spain



Dr. Manuel Rodríguez
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Dr. José Luis Casillas
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Dª Isabel Rodríguez
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Dr. María Jesús Villa
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D. Bonifacio Vega
MSc, MBA, Technology Transfer and Business Development Manager



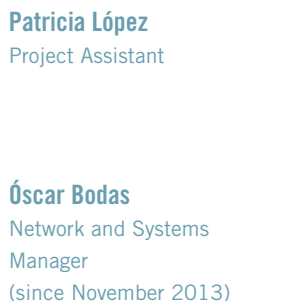
Patricia López
Project Assistant



David Sayago
POCAONTAS Project Manager



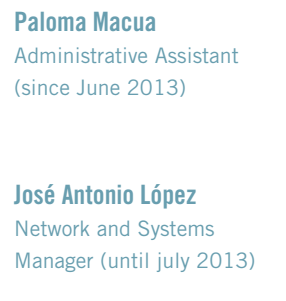
Paloma Macua
Administrative Assistant (since June 2013)



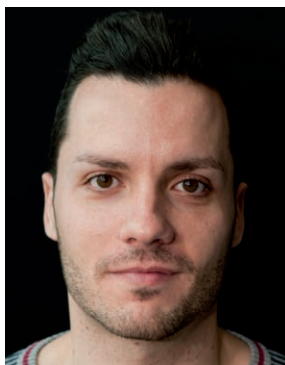
Óscar Bodas
Network and Systems Manager (since November 2013)



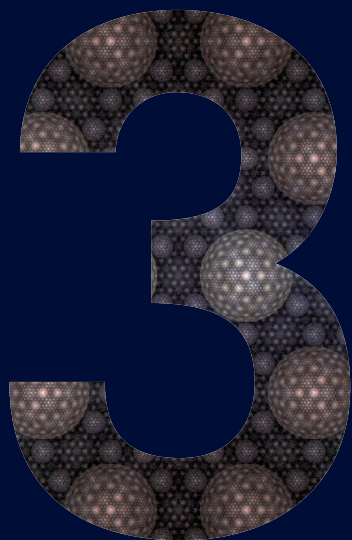
Santiago Rosado
Administrative Assistant (until June 2013)



José Antonio López
Network and Systems Manager (until July 2013)



scientific report



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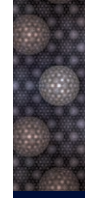
annual report
2013

3.1. Publications, contributions to books and patents

3.1.1. Publications

1. Density functional theory study of the structure and vibrational modes of acrylonitrile adsorbed on Cu(100) S. Díaz-Tendero, M. Alcamí and F. Martín *Phys. Chem. Chem. Phys.* **15**, 1288-1295 (2013); doi: [10.1039/c2cp42542d](https://doi.org/10.1039/c2cp42542d)
2. Multiparametric toxicity evaluation of SPIONs by high content screening technique: identification of biocompatible multifunctional nanoparticles for nanomedicine Prina-Mello, Adrielle; Crosbie-Staunton, Kieran; Salas, Gorka; del Puerto Morales, Maria; Volkov, Yuri *IEEE Transactions on Magnetism* 2013 **49**, 377-382 doi:[10.1109/TMAG.2012.2225024](https://doi.org/10.1109/TMAG.2012.2225024)
3. Two experiments that impacted the fate of fullerenes Martin, Nazario *Chem. Commun* 2013, **49** 1039-1041. doi:[10.1039/c2cc35608b](https://doi.org/10.1039/c2cc35608b)
4. Comparative response of biosensing platforms based on synthesized graphene oxide and electrochemically reduced graphene Garcia, S.; de Andres, A.; Pariente, F.; Lorenzo, E *Electroanalysis* 2013 **25** 154-165; doi:[10.1002/elan.201200480](https://doi.org/10.1002/elan.201200480)
5. Electrocatalytic Activity of 3-Dimensional Ordered Macroporous Gold Electrode-Based Lactate Biosensors Platforms as a Function of Pore Layer Number Gamero, M.; Fierro, J. L. G.; Lorenzo, E.; Alonso, C. *Electroanalysis* 2013 **25** 179-188; doi:[10.1002/elan.201200419](https://doi.org/10.1002/elan.201200419)
6. Influence of peripheral substitution on the magnetic behavior of single-ion magnets based on homo- and heteroleptic TbIII Bis(phthalocyaninate) Ganivet, Carolina R.; Ballesteros, Beatriz; de la Torre, Gema; Clemente-Juan, Juan M.; Coronado, Eugenio; Torres, Tomas *Chem. Eur. J.* 2013 **19** 1457-1465; doi: [10.1002/chem.201202600](https://doi.org/10.1002/chem.201202600)
7. Synthesis, characterization and photophysical properties of a melamine-mediated hydrogen-bound phthalocyanine-perylenediimide assembly Ángel J. Jiménez, Rafael M. Krick Calderón, M. Salomé Rodríguez-Morgade, Dirk M. Guldi and Tomás Torres *Chem. Sci.*, 2013, **4**, 1064-1074; doi: [10.1039/c2sc21773b](https://doi.org/10.1039/c2sc21773b)
8. Trapping fullerenes with jellyfish-like subphthalocyanines I. Sánchez-Molina, C. G. Claessens, B. Grimm, D. M. Guldi and T. Torres *Chem. Sci.*, 2013, **4**, 1338-1344; doi: [10.1039/C3SC21956A](https://doi.org/10.1039/C3SC21956A)
9. Fluoro-functionalization of vinylene units in a polyarylenevinylene for polymer solar cells: impact of fluorination on morphological and optical properties and on photovoltaic performances A. Cardone, C. Martinelli, M. Losurdo, E. Dilonardo, G. Bruno, G. Scavia, S. Destri, P. Cosma, L. Salamandra, A. Reale, A. Di Carlo, A. Aguirre, B. Milián-Medina, J. Gierschner, G. M. Farinola, J. *Mater. Chem. A* **1** (2013) 715-727; doi: [10.1039/c2ta00177b](https://doi.org/10.1039/c2ta00177b)
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11. Synthesis of unsymmetrical carboxyphthalocyanines by palladium-catalyzed hydroxycarbonylation of iodo-substituted precursors Garcia, IAD; Sevim, AM; de la Escosura, A; Torres, *Org. Biomol. Chem.*, 2013, **11**, 2237-2240; doi: [10.1039/c3ob27468c2013](https://doi.org/10.1039/c3ob27468c2013)
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14. **Unraveling the peculiar modus operandi of a new class of solvatochromic fluorescent molecular rotors by spectroscopic and quantum mechanical methods** Matthias Koenig, Giovanni Bottari, Giuseppe Brancato, Vincenzo Barone, Dirk M. Guldi and Tomás Torres *Chem. Sci.*, 2013, **4**, 2502-2511; doi:[10.1039/c3sc50290b](https://doi.org/10.1039/c3sc50290b)
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16. **Asymmetric organocatalysis in fullerenes chemistry: enantioselective phosphine-catalyzed cycloaddition of allenates onto C60** Marco-Martinez, Juan; Marcos, Vanesa; Reboredo, Silvia; Filippone, Salvatore; Martin, Nazario *Angew. Chem. Eng. Ed.* 2013 **52**, 5115-5119; doi: [10.1002/anie.201301292](https://doi.org/10.1002/anie.201301292)
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21. **Rapid fabrication of pressure-driven open-channel microfluidic devices in omniphobic RF paper** Ana C. Glavan, Ramses V. Martinez, E. Jane Maxwell, Anand Bala Subramaniam, Rui M. D. Nunes, Siowling Soha and George M. Whitesides *Lab Chip*, 2013, **13**, 2922-2930; doi: [10.1039/c3lc50371b](https://doi.org/10.1039/c3lc50371b)
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23. **Biophysical and rna interference inhibitory properties of oligonucleotides carrying tetrathiafulvalene groups at terminal positions** Sónia Pérez-Rentero, Alvaro Somoza, Santiago Grijalvo, Jirí Janoušek, Martin Belohradský, Irena G. Stará, Ivo Starý, and Ramon Eritja *Journal of Chemistry* **2013** Article ID 650610-[11 pp]; doi:[2013/650610/](https://doi.org/10.1039/650610/)
24. **Fluorescent DNA stabilized silver nanoclusters as biosensors** Alfonso Latorre, Romina Lorca, and Álvaro Somoza *Journal of Chemistry* 2013 Article ID 631421-[6 pp]; doi:[10.1155/2013/631421](https://doi.org/10.1155/2013/631421)
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- 27. Light-harvesting with panchromatically absorbing BODIPY-porphyrazine conjugates to power electron transfer in supramolecular donor-acceptor ensembles**, V. Engelhardt, S. Kuhri, J. Fleischhauer, M. García-Iglesias, D. González-Rodríguez, G. Bottari, T. Torres, D. M. Guldi, R. Faust *Chem. Sci.*, 2013, **4**, 3888-3893; doi: [10.1039/c3sc51622a](https://doi.org/10.1039/c3sc51622a)
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- 29. A voyage into the synthesis and photophysics of homo- and heterobinuclear ensembles of phthalocyanines and porphyrins**, G. de la Torre, G. Bottari, M. Sekita, A. Hausmann, D. M. Guldi, T. Torres *Chem. Soc. Rev.*, 2013, **42**, 8049-8105; doi: [10.1039/c3cs60140d](https://doi.org/10.1039/c3cs60140d)
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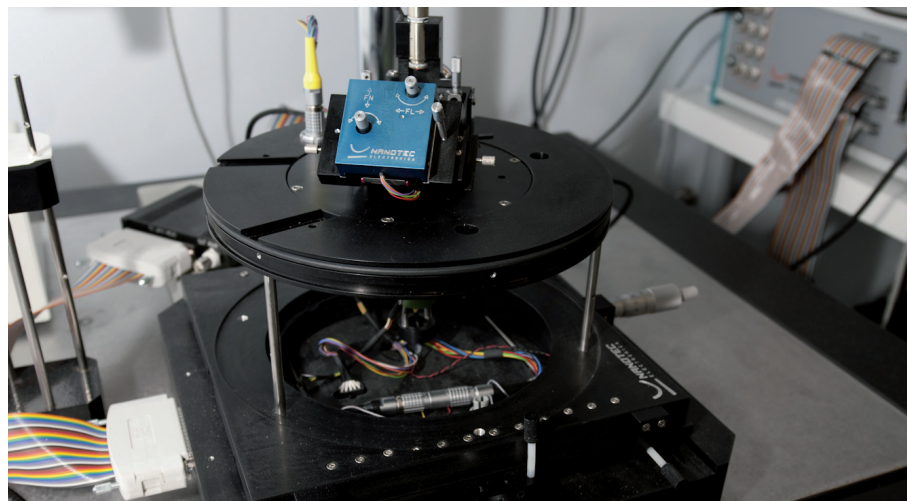
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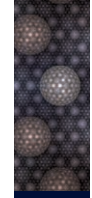
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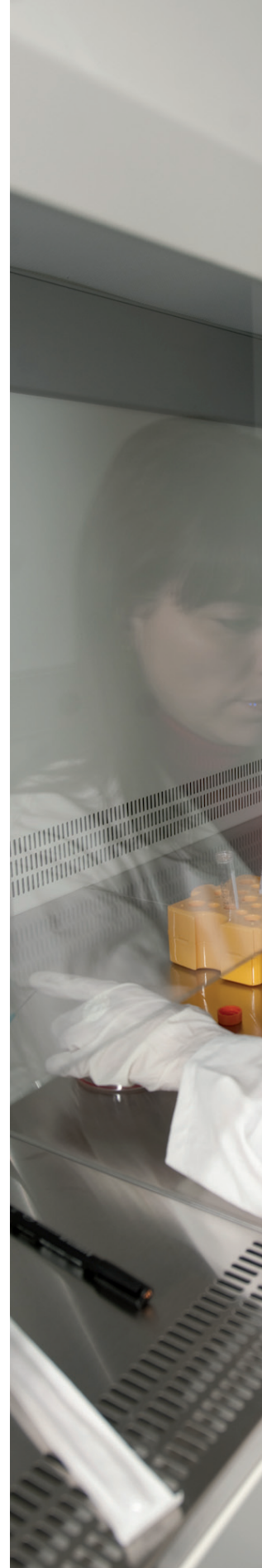


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3.1.2. Contributions to books

1. Covalent, donor-acceptor ensembles based on phthalocyanines and carbon nanostructures, G. Bottari, M. Urbani, T. Torres in *Organic Nanomaterials: Synthesis, Characterization, and Device Applications*, Editors: T. Torres and G. Bottari, John Wiley & Sons, Inc., Hoboken, New Jersey, 2013, ISBN: 978-1-118-01601-5

2. Cancer treatment using magnetic nanoparticles F.J.Teran M.P. Morales, A. Villanueva, J. Camarero, and R. Miranda, McGraw-Hill in *Yearbook of Science & Technology* 2013, pag. 64.

3. Optical Tweezers to study Viruses J.R. Arias-Gonzalez *Subcell Biochem.* 2013; 68:273-304 in *Structural and Physical Virology* M.G. Mateu, ed., (Springer) doi: 10.1007/978-94-007-6552-8_9

4. Organic Nanomaterials: Synthesis, Characterization, and Device Applications Tomas Torres, Giovanni Bottari, John Wiley & Sons, Inc., Hoboken, New Jersey, 2013, ISBN: 978-1-118-01601-5 No <http://eu.wiley.com/WileyCDA/WileyTitle/productCd-1118016017.html>

5. Using Molecular Reflectivity to Explore Reaction Dynamics at Metal Surfaces C. Díaz Blanco, F. Martín in *Dynamics of Gas-Surface Interactions*, Springer Series in Surface Science, 50, pp 75-100 (2013) ISBN: 978-3-642-32954-8

6. Genetically Encoded Photosensitizers: Structure, Photosensitization Mechanisms, and Potential Application to Photodynamic Therapy Cristina Flors and Santi Nonell. In "Handbook of Photomedicine", published October 22, 2013 by Taylor & Francis. Editors: Michael R. Hamblin, Ying-Ying Huang. ISBN 978-1-4398-8469-0 <http://www.crcpress.com/product/isbn/9781439884690>

3.1.3. Patents

Granted Patent Applications

1. Position Sensitive Photodetector: Spain's Patent Office (FULLY REGISTERED) - 50% ownership with CSIC. PCT Extended to Europe, EE.UU. and Japan. License in negotiation with Hamamatsu (NDA)

2. Solid Support for Oligonucleotide Synthesis: Registered at European Patent Office EPO – PCT Extension 100% IMDEA – License in negotiation with Link Technologies (NDA)

Filed Patent Applications

3. New Method for the Synthesis of Graphene Inks: EPO; IMDEA 25%, UAM 25%, Abengoa Research 50%. Pre-Commercial Licence Agreement with Abengoa Research

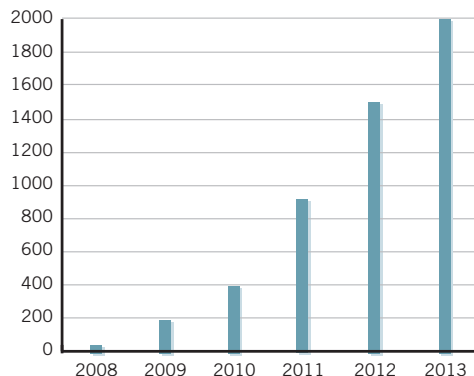
4. COF Covalent Organic Frameworks: European Patent EPO; IMDEA 50%, UAM 40% and UCM 10%

5. Preparation of Corrugated and Porous Graphene using COFs for its use as Supercapacitors: OEPM; UVEG 70%, UAM 17,5%, IMDEA 12,5%

6. Single-Point Mutation Detection in RNA Extracts using Gold Nanoparticles Modified with Hydrophobic Molecular Beacons: EPO patent filed at OEPM IMDEA 60%, University of California at San Francisco 40%, Interinstitutional Co-ownership agreement

7. Detection and treatment of GNAQ mutant uveal melanoma cells with metallic nanoparticles: USA patent filed at USPO: IMDEA 40%, University of California at San Francisco 40%, Interinstitutional Co-ownership agreement

Citations in each year



- Sum of the times cited: **5845**
- Sum of Times Cited without self-citations: **4961**
- Average citation per item: **12,38**
- h index: **37**

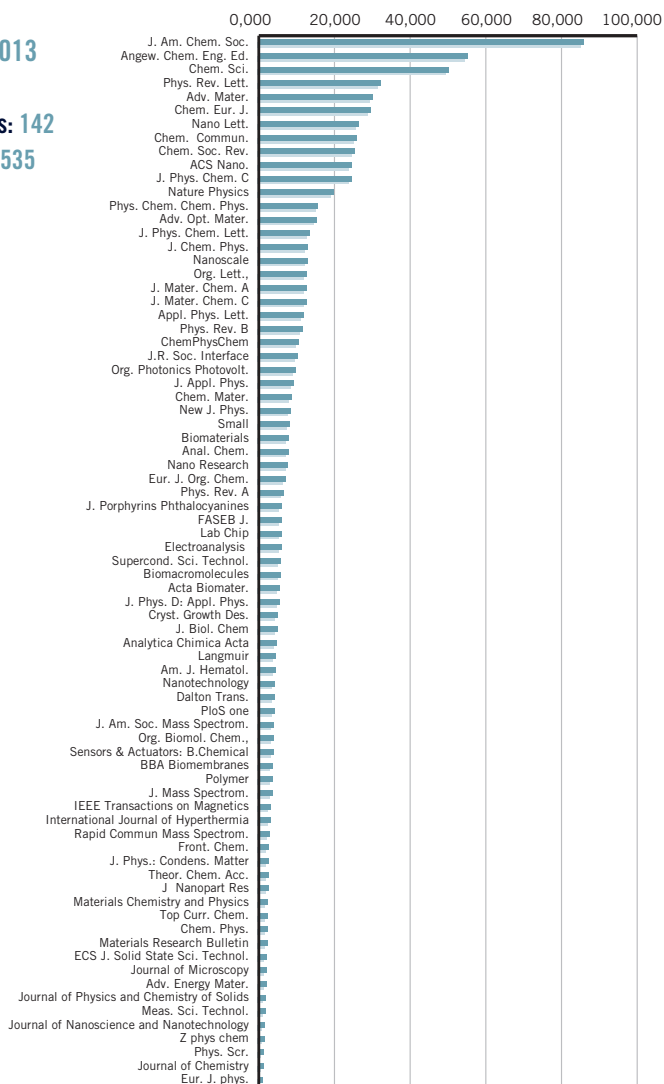
1. Periodically rippled graphene: growth and spatially resolved electronic structure

Vazquez de Parga A. L.; Calleja F.; Borca B.; Guinea F. and Miranda R., *Phys. Rev. Lett.* TC: 275

Impact factor of the publications in 2013

Total indexed publications: **142**

Average impact factor: **5,535**



3.2. International congresses: invited lectures and regular contributions

3.2.1. Invited lectures

22-23.01.2013

Workshop on Ion Physics Studied with High Energy Photons Hamburg, Germany

VUV/X-ray light for imaging and electronic control in molecules.

F. Martín

27.01-01.02.2013

37th International Conference & Exposition on Advanced Ceramics & Composites, Daytona Beach, USA

Controlled synthesis of SPIONs for biomedical applications

Gorka Salas, Macarena Calero, Pilar Acedo, Cintia Casado, Francisco J. Terán, Ángeles Villanueva, Julio Camarero, Rodolfo Miranda, and M. Puerto Morales

11.03.2013

Federal Institute for Materials Research and Testing, Adlerhof, Berlin Germany.

Nanoscience and Molecular Materials Based on Phthalocyanines

T. Torres

14.03.2013

Globasol, Università degli Studi del Piemonte Orientale "A. Avogadro", Alessandria, Italy

Phthalocyanines for Molecular Photovoltaics

T. Torres

20-24.03.2013

Second International Advanced Materials Science Networking (AMASING) Workshop, Da Nang, Vietnam

High-resolution friction force microscopy and applications to environmental issues

E. Gnecco & C. M. Pina

10.04.2013

245th ACS National Meeting, New Orleans, Louisiana, USA

Dye-Sensitized Solar Cells based on Metallophthalocyanines

T. Torres

12.04.2013

3rd Conference on Catalysis and Sensing for Environment (CASE), The University of Texas at Austin, Austin, USA

Photoactive Phthalocyanine and Subphthalocyanine-Based Ensembles

T. Torres

12-16.05.2013

223rd Meeting of the Electrochemical Society (ECS), Toronto, Canada

Organic Molecular Wires: Merging Through Space and Through Bond #,#-Coupling in [2,2'] Paracyclophane-o-PPV Wires

N. Martín

Organocatalysis in Fullerene Chemistry

N. Martín

Phthalocyanines and analogues as components of photovoltaic and artificial photosynthetic devices

M.-E. Ragoussi, M. Ince, L. Tejerina, O. Trukhina, M. Medel, E. M. Llamas, J. Guilleme, B. Ballesteros, G. de la Torre, M. V. Martinez-Diaz, G. Bottari, M. Urbani, T. Torres

20-24.05.2013

13th European Light Microscopy Initiative Meeting, Arcachon, France

Super-resolution fluorescence microscopy of DNA

C. Flors

22-23.05.2013

International Workshop on Hybrid Semiconductor Materials, University of Nicosia, Cyprus

Femtosecond probing of hybrid optoelectronic devices

Juan Cabanillas Gonzalez

24.05.2013

4th Georgian Bay International Conference on Bioinorganic Chemistry (CanBIC-4), Parry Sound, Ontario, Canada

Subphthalocyanines: Singular aromatic non-planar molecules

T. Torres

26-30.05.2013

96th Conference of the Canadian Society for Chemistry (CSC) Quebec, Canada

Optoelectronic Properties of Single Crystalline Conjugated Organic Materials

J. Gierschner

27-31.05.2013

E-MRS, Strasbourg, France

Thermo-responsive platforms with quantum dots and Au nanoparticles trapped by optical tweezers
Synthesis and optical studies

Beatriz H. Juárez

02-07.06.2013

11th International Symposium on Functional #electron Systems, Arcachon, France

Tailoring Electroactive Molecular Tweezers for Carbon Nanotubes

N. Martín.

04.06.2013

Optical Tweezers in Life Sciences, Berlin, Germany

Single-molecule manipulation of RNA structures: double-stranded helices and G quadruplexes

J. Ricardo Arias-Gonzalez

9-12.06.2013

XII Congreso Nacional de Virología, Burgos, Spain

New tools for the study of virus structure: Microscopies from atoms to cells.

J. López Carrascosa

19.06.2013

Red de Excelencia NoE Nanophotonics for Energy, Madrid, Spain

Hybrid systems based on semiconductor nanocrystals

Beatriz H. Juárez

24-28.06.2013

11th European Conference on Atoms Molecules and Photons (11th ECAMP), Aarhus, Denmark

Charge transfer between molecules and metal surfaces covered with ultrathin insulating films

M. Robledo, S. Díaz-Tendero, F. Martín and M. Alcamí

19-21.06.2013

International Congress of the Spanish Biophysical Society. SBE, Valencia Spain

Instruct Integration Biology: a Structural Biology Initiative (Chair)

J. López Carrascosa

Macromolecular Complexes Session 9 (Chair)

J. López Carrascosa

The Structure of Native Influenza Virion Ribonucleoproteins

Jaime Martín-Benito, Rocío Arranz, Rocío Coloma, F. Javier Chichon and J. López Carrascosa

26-28.06.2013

Supramolecular Functional Materials for Organic Electronics Conference ISIS, University of Strasbourg, Francia

Ordering Electroactive Small Molecules into Hierarchical Supramolecular Ensembles

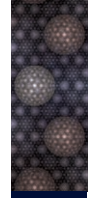
N. Martín.

01-05.07.2013

9th International Workshop on Magnetism and Superconductivity at the nanoscale Coma-ruga, Spain

Magnetic/superconducting hybrids: from percolation effects to wire network behaviors

J. L. Vicent



08-12.07.2013

4th Attosecond Physics Conference (ATTO 2013)
Paris, France

Correlated electron and nuclear dynamics in strong field photoionization and high-harmonic generation from the H_2^+ molecular ion.

F. Martín

08-09.07.2013

VI Workshop Nanociencia y Nanotecnología, Alcalá de Henares, Spain

Grafting Dyes on graphene/gold electrodes

Revenga-Parra, M., C. Anquela, J.M. Abad, F. Pariente, E. Lorenzo

13-17.07.2013

9th European Biophysics Congress. Lisbon, Portugal.

Supramolecular Assemblies (Chair)

J. López Carrascosa

Femtosecond crystallography: Dawn of a new era in structural biology (Chair)

J. López Carrascosa

24-30.07.2013

Congress: XXVIII International Conference on Photonic, Electronic, and Atomic Collisions (ICPEAC2013) Place: Lanzhou (China)

Ultrafast nonadiabatic fragmentation dynamics of biomolecules

M. Alcamí

28.07-02.08.2013

International Symposium on Novel Aromatics (ISNA-15) Universidad de Taipei, Taiwan

Electroactive Molecular Receptors for SWCNTs: #, #-ordering Motif

N. Martín.

17-20.08.2013

14th ISEAC, Chanchung, China

Nanomaterials for electrochemical sensing platforms

María Encarnación Lorenzo Abad

19.08.2013

International Conference on "Solar Energy for World Peace" Istanbul, Turkey.

Phthalocyanines for Molecular Photovoltaics

T. Torres

01-06.09.2013

6th International Workshop on Surface Physics, Niemzca (Poland)

Dynamical effects on the self-assembly of organic molecules on solid surfaces

R. Otero

03-06.09.2013

ALBA User Meeting. VI AUSE Conference, Barcelona, Spain

Cartography of a whole cell by cryo-synchrotron Xray nano-tomography

J.L. Carrascosa

09-13.09.2013

Trends in Nanotechnology 2013, Sevilla, Spain

Dynamical effects on the self-assembly of organic molecules on solid surfaces

R. Otero

15-18.09.2013

XXXIV Reunión Bienal de la Real Sociedad Española de Química, Santander, Spain

New Organic Materials for OPV

Juan Luis Delgado

Modified oligonucleotides in nanotechnology and nanomedicine

Álvaro Somoza

Chiral Fullerenes from Asymmetric Catalysis

N. Martín



12.10.2013

International Conference on Advanced Polymeric Materials (ICAPM) Mahatma Gandhi University, Kottayam, Kerala, India

Organic-Inorganic Hybrid Materials and Polymers based on Phthalocyanines for Molecular Photovoltaics

T. Torres

21-27.10.2013

2013 EMN Open Access Week Chengdu, China

Dynamical effects on the self-assembly of organic molecules on solid surfaces

R. Otero

04-06.11.2013

ITAMP Workshop on ultrafast atomic and molecular physics with cutting-edge light sources: New opportunities and challenges, Manhattan, Kansas, USA

Clocking ultrafast wave packet dynamics in molecules through UV-induced symmetry breaking

F. Martín

04-08.11.2013

58th MMM 2013 Denver, USA

Imaging magnetization reversal of interfacial exchange coupling

J. Camarero, E. Jiménez, P. Perna, A. Bollero, J.L.F. Cuñado, D. Maccariello, R. Miranda, J. Vogel, C. Tieg, F. Yakhou-Harris, G. Gaudin, B. Rodmacq, E. Gautier, S. Auffret, B. Delaup, and B. Dieny

18-19.11.2013

First Joint CSIC-CNRS Workshop "Nanomaterials for Health", Madrid, Spain

Identification of a list of topics for bilateral collaborations

G. Salas

21-22.11.2013

User Workshop at Extreme Light Infrastructure-Attosecond Light Pulse Source (ELI-ALPS), Szeged, Hungary

Clocking ultrafast molecular dynamics by using XUV-pump/XUV-probe schemes.

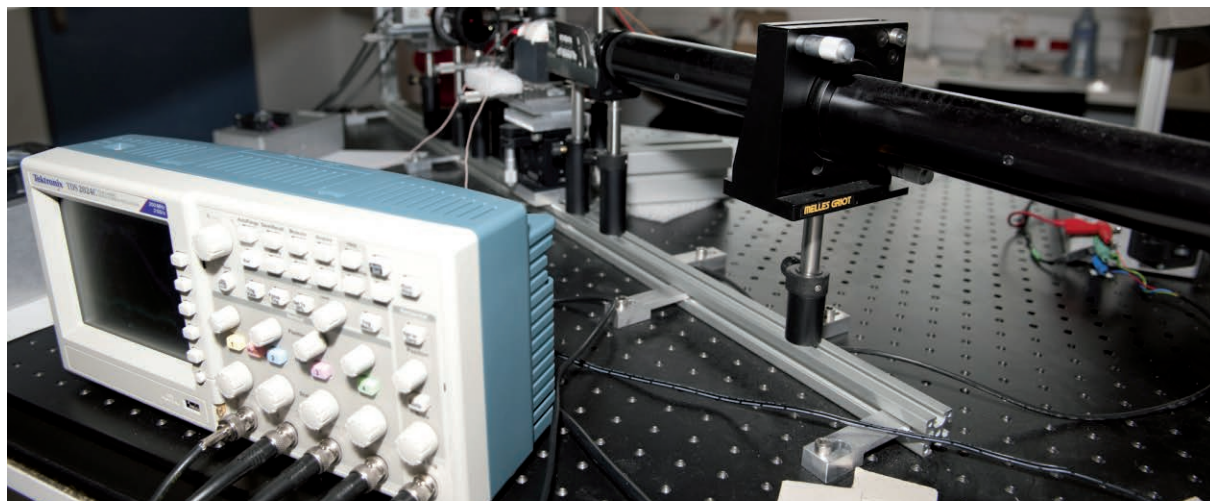
F. Martín

24-27.11.2013

9th Korea-Japan Symposium on Frontier Photo-science (KJFP) Seoul, Korea

Photophysics in Conjugated Organic Materials by Design: Intra- & Intermolecular Structural Motifs and Solid State Morphology

J. Gierschner



3.2.1. Regular contributions

31.01.-02.02.2013

4th Symposium on Computing pi-Conjugated Compounds (CPiC), Marseille, France

Oral Contribution

Tailor-Made Highly Luminescent and Ambipolar Transporting Organic Mixed Stacked Charge-Transfer Crystals

J. Gierschner

02-07.02.2013

Photonics West, San Francisco, USA

Oral Contribution

Fluorescent proteins as singlet oxygen photosensitizers: mechanistic studies in photodynamic inactivation of bacteria

Ruiz-González R, White JH, Cortajarena AL, Agut M, Nonell S, Flors C

04-05.02.2013

2nd Meeting of the RSEQ Chemical Group Bilbao, Spain

Poster Contribution

Repeat protein scaffolds for assembly of tailored nanostructures

S.H. Mejías; P. Couleaud, S. Casado; Begoña Sot; J.M. Abad; A.L. Cortajarena

20-22.02.2013

International Workshop "Magnifyco"2013, Barcelona, Spain

Poster Contribution

Improving the accuracy for determining SAR values in superparamagnetic nanoparticles under non-adiabatic conditions

N. Mikuszeit; G. Salas; M.P. Morales; J. Camare-ro; R. Miranda and F.J. Teran

04-05.03.2013

3rd Strategic Japanese-Spanish Cooperative Program on Nanotechnologies and new materials for environmental challenges Universidad de Tsukuba, Tsukuba, Japón

Oral Contributions

Endofullerenes for Photovoltaic Devices

N. Martín

Asymmetric Synthesis of Fullerenes

N. Martín

07-11.04.2013

245th ACS National Meeting (Graphene Meeting) American Chemical Society (ACS), New Orleans, USA

Oral Contribution

Towards electroactive graphene by chemical modification

N. Martín.

14-18.04.2013

International Biolron Society Annual Meeting 2013 London, UK

Poster Contribution

Iron bioavailability from ingested iron oxide nanoparticles"

S. Chamorro, A. Brenes, A. Viveros, C. Romero, L. Gutiérrez, G. Salas, Y. Luengo, M.P. Morales, and F. J.Teran

23-26.04.2013

TD-DFT Conference, Nantes, France

Poster Contributions

Td-DFT molecular dynamics simulations on the fragmentation of doubly charged methionine

Yang Wang; Dang Trinh Ha; Michael Huels; Eero Itälä; Kuno Kooser; Samuli Urpelainen; Edwin Kuk; Manuel Alcamí; Fernando Martín

05-10.05.2013

Gordon Research Conference, Lucca, Italy

Oral Contribution

Viruses and Cells "Building the viral replication organelle by a double stranded DNA virus.

Cuesta-Geijo M.A., M. Chiapi, I. Galindo, J. Chichón, R. Muñoz-Moreno, J. López Carrascosa and C. Alonso

12-17.05.2013

223rd Electrochemical Society Meeting (ECS) Electrochemical Society Inc. Toronto, Canadá

Oral Contributions

Supramolecular Chemistry of Carbon Nanostructures: Concave-convex Interactions

N. Martín.

Towards electroactive graphene by chemical modification

N. Martín.

27-31.05.2013

European Materials Science Society (E-MRS) Spring Meeting 2013, Strasbourg, France

Poster Contribution

Biocompatible small-molecule coatings for iron oxide magnetic nanoparticles prepared via thermal decomposition

Gorka Salas and M. Puerto Morales

Oral Contribution

Synthesis and optical trapping of individual thermo-responsive beads with colloidal quantum dots and Au nanoparticles

S. Hormeno, H. Lange, J.R. Arias-Gonzalez and B.H. Juarez

12-14.06.2013

4th European Nanomanipulation Workshop, Krakow, Poland

Oral Contribution

Manipulation of Gold Nanoparticles on Glass Surfaces Patterned by Ion-Beam Sputtering & Ultrasonics for Nanomanipulation

P. Nita, E. Gnecco, R. Wannemacher

12.06.2013

Workshop on Chemistry and Molecular Imaging (ICMM-CNIC), Madrid, Spain

Oral Contribution

Assessing magnetic nanoparticle cytotoxicity
Gorka Salas

16-19.06.2013

XVIII Reunión SEQA, Ubeda, Jaen, Spain

Oral Contribution

Grafting of Azure A on gold electrodes for sensing applications

C. Anquela, M. Revenga-parra, J. M. Abad, F. Pariente, E. Lorenzo

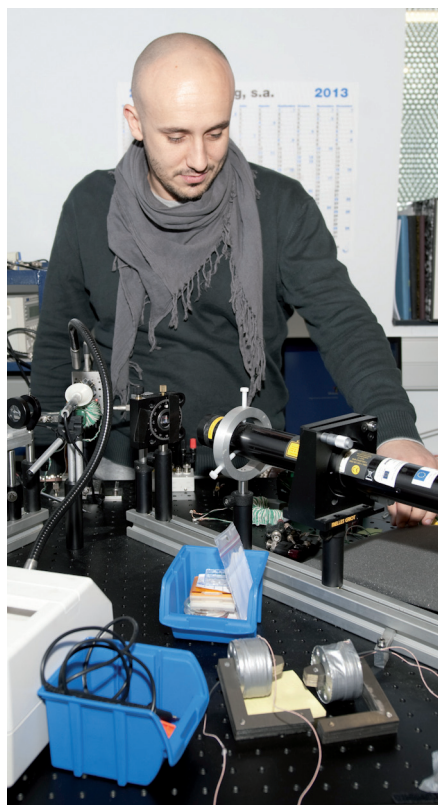
16-21.06.2013

Gordon Research Conference, Proteins Plymouth,, NH, USA

Poster Contribution

Self-Assembly of repeat protein scaffolds into fibers and monolayers

S.H. Mejias; M.A. Garcia; S. Casado; J.M. Abad; A.L. Cortajarena.



19-21.06.2013

IX Meeting on Nucleic Acids and Nucleosides, Mieres, Spain**Oral Contributions**

Mechanical Identities of RNA and DNA Double Helices Unveiled at the Single-Molecule Level
E. Herrero-Galan, M.E. Fuentes-Pérez, C. Carrasco, J.M. Valpuesta, J.L. Carrascosa, F. Moreno-Herrero and J.R. Arias-Gonzalez

DNA Stabilized Gold Nanoparticles as delivery system

Alfonso Latorre Lozano; Christian Posch; Susana Ortiz; Alvaro Somoza

24-28.06.2013

Congress: 11th European Conference on Atoms Molecules and Photons (11th ECAMP), Aarhus, Denmark**Poster Contribution**

Fragmentation dynamics of excited ionized polycyclic aromatic hydrocarbons

M. Alcamí, C. Paris, H. Silva Jr., S. Díaz-Tenreiro, M. Rapacioli, F. Spiegelman, F. Martín

30.06-05.07.2013

Biological Surfaces and Interfaces, FEBS workshop, Sant Feliu, Spain**Poster Contribution**

Self-assembly of designed repeated proteins into ordered monolayers and solution polymers

S.H. Mejías; S. Casado; J.M. Abad; B. Sot, A.L. Cortajarena.

03-07.07.2013

ICMAT 2013 Suntech City, Singapore**Oral Contribution**

Effect of oxygen on the primary photoevents of P3HT:PCBM blends

Larry Lueer, R. Sai Santosh Kumar, T. Sauer-mann, H-J. Egelhaaf, G. Lanzani

Poster Contribution

Self-assembly of designed repeated proteins into ordered monolayers and solution polymers

S.H. Mejías; S. Casado; J.M. Abad; B. Sot, A.L. Cortajarena.

08-09.07.2013

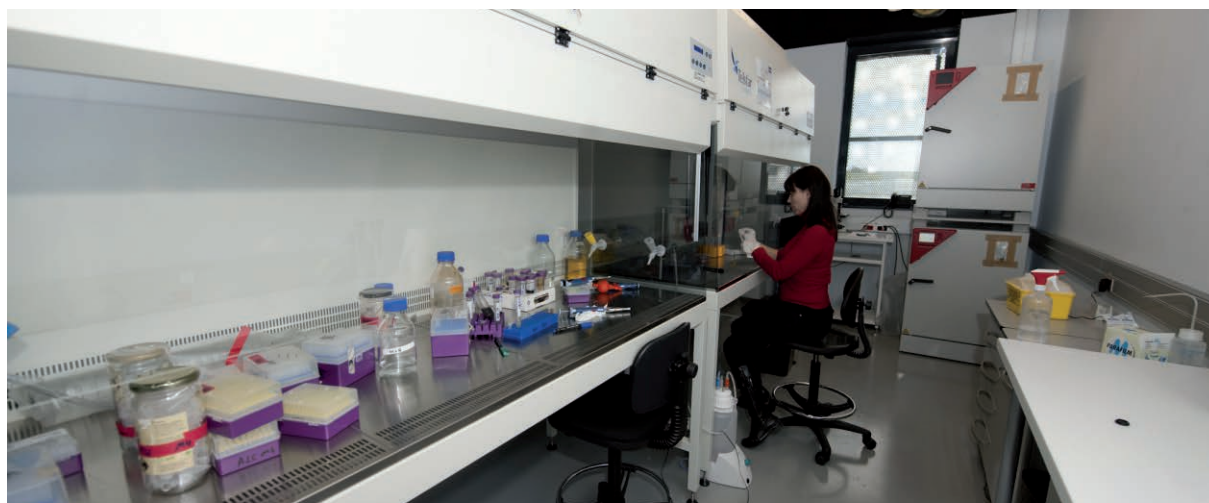
VI Workshop Nanociencia y Nanotecnología, Alcalá de Henares, Spain**Oral Contributions**

PH-dependant optical properties of dye-gold nanoparticle hybrid system

Iria Bravo, M. Revenga-Parra, T. García, F. Pariente, J.M. Abad, E. Lorenzo

Electrochemically generated Pt-Pt nanostructures

E. Martínez-Periñán, J.M. Abad, F. Pariente, M.-R. Azani, R. Mas-Bellesté, F. Zamora, E. Lorenzo.



11-13.07.2013

24 Reunión Bienal de Química Orgánica Universidad de San Sebastián, San Sebastián, País Vasco, España

Oral Contribution

Supramolecular Chemistry of Carbon Nanostructures: Concave-convex Interactions

N. Martín.

14-19.07.2013

Optical Probes of Conjugated Polymers and Organic Nanostructures, Durham, England

Oral Contributions

Tuning of Optical & Photophysical Properties in Single Crystals of pi-Conjugated Compounds
J. Gierschner

Optical and Vibrational Properties of Highly Emissive Substituted Dicyanodistyrylbenzene Single Crystals

S. Varghese, B. Milián-Medina, Johannes Gierschner, Reinhold Wannemacher

15-19.07.2013

XXXIV Biannual Meeting of the Spanish Royal Society of Physics, Valencia, Spain

Oral Contribution

A Maxwell's demon that replicates genetic information

J.R. Arias-Gonzalez

Poster Contribution

Self-assembly of designed repeated proteins into ordered monolayers and solution polymers
S.H.Mejías; S. Casado; J.M. Abad; B. Sot, A.L. Cortajarena.

19-22.07.2013

XXIII International Symposium on Ion Atom Collisions (ISIAC 20139, Beijing, China

Poster Contribution

Collisions of ions with clusters of fullerenes: decay pathways and covalent bond formations

F. Seitz, H. Zettergren, P. Rousseau, Y. Wang, T. Chen, M. Gatchell, J. D. Alexander, M. H. Stockett, J. Rangama, J. Y. Chesnel, M. Capron, J. C. Pouilly, A. Domaracka, A. Méry, S. Maclot, V. Vizcaino, H. T. Schmidt, L. Adoui, M. Alcamí, A. G. G. M. Tielens, F. Martín, B. A. Huber and H. Cederquist

21-26.07.2013

26th International Conference on Photochemistry, Leuven, Belgium

Oral Contribution

Singlet oxygen generation by the genetically-encoded tag miniSOG

Ruiz-González R, Cortajarena AL, Mejias SH, Agut M, Nonell S, Flors C

21-26.07.2013

International Summer School NC: Biomolecules and single molecule techniques, Madrid, Spain

Poster Contributions

Direct measurement of phi29 phage stiffness provides evidence of internal pressure.

M. Hernando-Pérez, R. Miranda, M. Aznar, J.L. Carrascosa, I.A.T. Schaap, D. Reguera and P.J. de Pablo.

Mechanical Identities of RNA and DNA Double Helices Unveiled at the Single-Molecule Level

Elías Herrero-Galán, María Eugenia Fuentes-Pérez, Carolina Carrasco, José M. Valpuesta, José L. Carrascosa, Fernando Moreno-Herrero and Ricardo Arias-González

24-30.07.2013

XXVIII International Conference on Photonic, Electronic and Atomic Collisions (ICPEAC 2013), Lanzhou, China

Poster Contributions

Fragmentation dynamics of doubly charged methionine and alanine molecules induced by core photoionization

Yang Wang, Dang Trinh Ha, Estefanía Rossich, Michael Huels, Itäláz, Kuno Kooser, Samuli Urpelainen, Edwin Kukk, Manuel Alcamí, Fernando Martín

04-08.08.2013

EMBO Harden Conference. Helicases and nucleic acid translocases, Cambridge, UK

Poster Contributions

Translocation dynamics of a 'hybrid DNA polymerase-helicase' level

Morín, J.A., Cao, J.M: Lázaro, F.J, Valpuesta, J.M., Salas, M., Carrascosa, J.L., Ibarra, B.

25-30.08.2013

JEMS 2013 Joint European Magnetic Symposia Rhodes, Greece.

Oral Contributions

Origin of the Anisotropic GMR in Magnetic Multilayers

P. Perna, D.Maccariello, C.Rodrigo, J.L.F.Cuñado, A.Bollero, M.Muñoz, J.L.Prieto, J.Akerman, M.Romera, V.Cros, J.Camarero and R.Miranda

Imaging magnetization reversal of interfacial exchange coupling

J. Camarero, E.Jiménez, P. Perna, A.Bollero, J.L.F. Cuñado, D. Maccariello, R.Miranda, J. Vogel, C. Tieg, F. Yakhou-Harris, G.Gaudin, B. Rodmacq, E. Gautier, S.Auffret, B. Delaup, and B. Dieny

Highly efficient heat dissipation in monodisperse iron oxide nanoparticles

G. Salas, H. Takacs, J. Camarero, R. Miranda, M.P. Morales, & F.J.Teran

Poster Contributions

Field-induced reduced coercivity and positive exchange bias in co/mnf2 bilayers

J. L. F. Cuñado, C. Rodrigo, D. Maccariello, P. Perna, A. Bollero, R. Miranda, D. A. Baranov, S. V. Gastev, S. M. Suturin, A. G. Banskchikov, V. V. Fedorov, L. Pasquali, J. Nogués, N. S. Sokolov, and J. Camarero

Simultaneous study of magnetization reversal and magnetoresistance in uniaxial magnetic anisotropy systems

D.Maccariello, P.Perna, J.L.F.Cuñado, A.Bollero, M.A.Niño, J.Pedrosa, M.Muñoz, J.L.Prieto, J.Camarero and R.Miranda

25-30.08.2013

Sol-Gel 2013. Madrid, Spain

Oral Contribution

Thermo-responsive platforms with quantum dots and Au nanoparticles trapped by optical tweezers Synthesis and optical studies".

Beatriz H. Juárez

02-06.09.2013

European Society for Photobiology Congress, Liège, Belgium

Oral Contribution

Singlet oxygen generation by the genetically-encoded tag miniSOG

Ruiz-González R, Cortajarena AL, Mejias SH, Agut M, Nonell S, Flors C

04.09.2013

12th European Conference on Molecular Electronics ECME-2013, London U. K.

Oral Contributions

Polyfluorene based rib waveguides for chemical sensing applications

Gonzalo del Pozo, Marta Mróz, Ramón Bernardo, Daniel Granados, Yan Qian, Ruidong Xia, Nouredinne Benis, Jose Manuel Otón, Xabi Quintana, Beatriz Romero, and Juan Cabanillas Gonzalez

A Detailed Study into the Properties of C60 Dumbbell Electrical Junctions

E. Leary; M. T. González; C. Evangeli; G. Rubio-Bollinger; N. Agraït.

Stability and breakage mechanism of molecular junctions based on different anchoring groups

M. T. González; E. Leary; A. Díaz; C. Evangeli; G. Rubio-Bollinger; N. Agraït

Features of the magnetization reversal mechanisms in the magnetoresistive response of magnetic nanostructures

P. Perna, D. Maccariello, C. Rodrigo, M. Muñoz, J.L. Prieto, A. Bollero, J.L. F. Cuñado, M.A. Niño, C. Navío, J. Camarero, R. Miranda

Nanospectroscopy On Fec Magnetic Alloy Films: Electronic Interface Effects In Organic-Metal Films

M. A. Niño, F. J. Luque, P. Perna, I. O. Kowalik, T. O. Montes, A. Locatelli, L. Aballe, D. Arvanitis, R. Miranda, J. J. de Miguel

09-13.09.2013

Donostia International Conference on Nanoscaled Magnetism and Applications (DICNMA) Donostia (Spain)

Oral Contributions

Origin of the anisotropic gmr in magnetic multilayers

P.Perna, D.Maccariello, C.Rodrigo, J.L.F.Cuñado, A.Bollero, M.Muñoz, J.L.Prieto, J.Akerman, M.Romera, V.Cros, J.Camarero and R.Miranda

Imaging Magnetization Reversal Of Interfacial Exchange Coupling

J. Camarero, E.Jiménez, P. Perna, A.Bollero, J.L.F. Cuñado, D. Maccariello, R.Miranda, J. Vogel, C. Tieg, F. Yakhou-Harris, G.Gaudin, B. Rodmacq, E. Gautier, S.Auffret, B. Delaup, and B. Dieny

Field-induced reduced coercivity and positive exchange bias in co/mnf2 bilayers

J. L. F. Cuñado, C. Rodrigo, D. Maccariello, P. Perna, A. Bollero, R. Miranda, D. A. Baranov, S. V. Gastev, S. M. Suturen, A. G. Banshchikov,

V. V. Fedorov, L. Pasquali, J. Nogués, N. S. Sokolov, and J. Camarero

Simultaneous study of magnetization reversal and magnetoresistance in uniaxial magnetic anisotropy systems

D.Maccariello, P.Perna, J.L.F.Cuñado, A.Bollero, M.A.Niño, J.Pedrosa, M.Muñoz, J.L.Prieto, J.Camarero and R.Miranda

09-13.09.2013

19th International Vacuum Conference, Paris, France

Oral Contributions

Intercalation of lead in graphene on Ir(111)

F. Calleja, S. Barja, M. Garnica, A.L. Vázquez de Parga and R. Miranda

Kondo resonance and inelastic tunneling spectroscopy on individual TCNQ molecules deposited on nanostructure graphene

M. Garnica, D. Stradi, F. Calleja, S. Barja, C. Díaz, M. Alcamí, N. Martín, A.L. Vázquez de Parga, F. Martín and R. Miranda

Elastic response of graphene nanodomains

D. Stradi, S. Koch, E. Gnecco, S. Barja, S. Kawai, C. Díaz, M. Alcamí, F. Martín, A.L. Vázquez de Parga, R. Miranda, T. Glatzel and E. Meyer

Electron localization on periodically rippled graphene

S. Barja, B. Borca, M. Garnica, D. Sánchez-Portal, V.M. Silkin, E.V. Chulkov, A.Arnau, A.L. Vázquez de Parga, R. Miranda

Oligomerization of TCNQ-type Electron Acceptors via Unprecedented Surface-Assisted Decyanation Reaction

R. Otero, C. Urban, Y. Wang, J. Rodríguez-Fernández, R. García, M.Á. Herranz, M. Alcamí, N. Martín, F. Martín, J.M. Gallego, R. Miranda.

Features of the magnetization reversal mechanisms in the magnetoresistive response of magnetic nanostructures

P. Perna, D. Maccariello, C. Rodrigo, M. Muñoz, J.L. Prieto, A. Bollero, J.L. F. Cuñado, M.A. Niño, C. Navío, J. Camarero, R. Miranda

Nanospectroscopy on ferromagnetic alloy films: electronic interface effects in organic-metal films

M. A. Niño, F. J. Luque, P. Perna, I. O. Kowalik, T. O. Montes, A. Locatelli, L. Aballe, D. Arvanitis, R. Miranda, J. J. de Miguel

New organic interactions at solid surfaces controlled by charge transfer

Koen Lauwaet, Jonathan Rodríguez Fernández, Raúl García, M. Ángeles Herranz, Nazario Martín, José M. Gallego, Roberto Otero, and Rodolfo Miranda

Poster Contribution

Stability and breakage mechanism of molecular junctions based on different anchoring groups

M. T. González; E. Leary; A. Díaz; C. Evangeli; G. Rubio-Bollinger; N. Agrait

15-18.09.2013

XXXIV Reunión Bienal de la Real Sociedad Española de Química, Santander Spain

Oral Contributions

Modificación superficial, con moléculas pequeñas, de nanopartículas magnéticas obtenidas por descomposición térmica

Gorka Salas, Francisco J. Terán and M. Puerto Morales

Peptide functionalization of magnetic nanoparticles for cancer detection and/or hyperthermia treatment.

Couleaud P., Latorre A., Aires A., Salas Hernández G., Calero M., Morales P., Somoza Á., Villanueva Á., Cortajarena A.L.,

Peptide functionalization of magnetic nanoparticles for cancer detection and/or hyperthermia treatment

P. Couleaud, A. Latorre, A. Aires, G. Salas, M. Calero, M. Morales, Á. Somoza, Á. Villanueva, A. Cortajarena

Poster Contribution

DNA Stabilized Gold Nanoparticles as delivery system

Alfonso Latorre Lozano; Christian Posch; Susana Ortiz; Alvaro Somoza

17-20.09.2013

Microscopy at the Frontiers of Science 2013, Taragona, Spain

Oral Contributions

Qualitative and quantitative analysis of Fe magnetic nanoparticles designed for antitumoral therapy

M. Chiappi, M.J. Rodríguez, F.J. Chichón, E.K. Henzler, S. Werner, P. Guttman, E. Pereiro, G. Schneider and J.L.Carrascosa.

Vaccinia Virus (VACV) development inside infected cells by soft X-ray tomographic reconstruction.

F.J. Chichón, M.J. Rodríguez, M. Chiappi, E. Pereiro, P. Guttman, S. Werner, E.K.Henzler, B. Perdiguero, G. Schneider, M. Esteban and J.L.Carrascosa

Poster Contribution

Structural characterization of the Phi29 Tail complex During DNA Injection

F.J. Chichón, A. Cuervo, J.J.Conesa, A. Camacho and J.L.Carrascosa

22-28.09.2013

IUMRS-ICAM2013 International Conference on Advanced Materials Qingdao, China

Oral Contributions

Nanoscale Perpendicular Magnetic Dot Arrays Fabricated by Extreme Ultraviolet Interference Lithography (EUV-IL)

F. Luo, L. J. Heyderman, H. H. Solak, T. Thomson

30.09-04.10.2013

Nanoimprint and nanoprint 2013 (NNT2013), Barcelona, Spain

Poster Contributions

Bioinspired super-hydrophobic self cleaning surfaces from hierarchically assembled templates

Audrey Yoke Yee Ho, Emma Luong, Hong Yee Low, Isabel Rodríguez, Chee Tiong Lim, Sriram Natarajan, Noha Elmouelhi, Murty Vyakarnam, Kevin Cooper





08-09.10.2013

Bio-inspired nanotechnologies Leipzig, Germany

Oral Contribution

Self-assembly of repeat proteins scaffolds into ordered films, fibers and monolayers

Aitziber L. Cortajarena

08.-11.10.2013

Excited States and Complex Environments Münster, Germany

Poster Contributions

Modeling of Optical Properties of Conjugated Oligomers & (Co)Polymers: How accurate is TD-DFT ?

M. Wykes

11-12.10.2013

Encuentro Multidisciplinar de Neurooncología Española 2013, Pamplona, Spain.

Extracellular microvesicles derived from glioblastoma cells could improve tumor diagnosis and follow-up of patients. Noemí García Romero, Josefa Carrión Navarro, Lorea Manterola, Marta Alonso, Ricardo Prat Acín, Cristóbal Belda Iniesta, Ángel Ayuso Sacido.

11.10.2013

International Symposio on New Materials Trieste University, Italia

Oral Contribution

Enantioselective Prato Reaction

N. Martín

24.10.2013

The Irago Conference, Tahara, Japan

Poster Contributions

Innovative capsule for measuring aqueous samples by transmission electron microscopy

T. Takamura, S. Koide, P. J. Ko, T. Tahara, S. Ishizawa, M. Ishida, P. Southern, D. Ortega, Q. Pankhurst and A. Sandhu

27.10-01.11.2013

AVS 60th International Symposium and Exhibition, Long Beach, California (E.E.U.U.)

Oral Contribution

Evidence of long range magnetic order in a purely organic 2D layer adsorbed on epitaxial graphene

M. Garnica, D. Stradi, S. Barja, F. Calleja, C. Díaz, M. Alcamí, N. Martín, A.L. Vázquez de Parga, F. Martín, R. Miranda

04-08.11.2013

58th MMM 2013 Denver, USA

Oral Contribution

Origin of the anisotropic gmr in magnetic multilayers

P. Perna, D.Maccariello, C.Rodrigo, J.L.F.Cuñado, A.Bollero, M.Muñoz, J.L.Prieto, J.Akerman, M.Romera, V.Cros, J.Camarero and R.Miranda

06-09.11.2013

X Simposio de Investigadores Jóvenes RSEQ-Sigma Aldrich Madrid, Spain

Oral Contribution

DNA Stabilized Gold Nanoparticles as delivery system

Alfonso Latorre Lozano; Christian Posch; Susana Ortiz; Alvaro Somoza

10-12.12.2013

6th International Summit on Organic Photovoltaic Stability Aix-les-Bains, FR

Poster Contributions

Modeling of Optical Properties of Conjugated Oligomers & (Co)Polymers - Concepts and Methods

M. Wykes

3.3. Workshops & Courses (Co)- Organized by IMDEA-Nanociencia

03-07.02. 2013

**XIV Escuela Nacional de Materiales Moleculares,
Almagro, España**

<http://www.icmol.es/XIVENMM/>

Células Solares Orgánicas e Híbridas

J.L. Delgado

*Más allá del grafeno: Polímeros bidimensionales
sintéticos.*

F. Zamora

16.-17.02.2013

Workshop on Molecular Electronics, Madrid, Spain

*Structure-Property Control in Conjugated Organic
Materials for Optoelectronic Applications*

J. Gierschner

High conductance metal-organic nanostructures.

F. Zamora

14.-16.05.2013

Workshop Molecular Interactions - Atoms to Networks. Rice University, Huston, USA

Physics of Living Systems Network

A.L. Cortajarena

05.06. 2013

**Scientific School on Nanotechnology, Kazan
National Research Technological University,
Kazan, Republic of Tatarstan, Russian Federation.**

Phthalocyanines for molecular photovoltaics

T.Torres

01-14.06.2013

**The 4th European Nanomanipulation Workshop,
Krakow, Poland**

<http://www.nanomanipulation2013.nanosam.pl/>

Enrico Gnecco (chairman)

Spinning and Translational Motion of Sb Nanoislands Manipulated on MoS₂

Pawel Nita

Manipulation of gold nanoparticles on glass surfaces patterned by ion-beam sputtering

Reinhold Wannemacher

17.-21.06.2013

**ESTABLIS Summer School in Quantum Chemical
Modelling, Miraflores, Spain**

Excited States of Conjugated Organic Materials

J. Gierschner

*Dynamic modelling: from time-resolved spectra
to a photophysical model,*

L. Lüer

*Exploring Chemical Reactivity with Computational Chemistry and Hands-On Workshop:
Quantum-Chemical Modelling*

M. Wykes

An Introduction to Quantum Chemistry and Calculation of Molecular Properties

Begoña Milian

27-28.06.2013

3rd Early Stage Researchers Workshop, Madrid, Spain

21-26.07.2013

**International Summer School Nicolas Cabrera:
Biomolecules and single molecule techniques,
Madrid, Spain**

Optical tweezers to study DNA replication dynamics at single molecule level

B. Ibarra

Mechano-chemical characterization of the genetic information carriers

J.R. Arias-Gonzalez



workshops
& courses



26-27.09.2013

III Hispano Japanese Symposium of Carbon Nanoforms.

Link: <http://www.nanoscience.imdea.org/sites/default/files/images/WORKSHOPS/CarbonNanoformsBookofAbstracts.pdf>

Organic Materials for OPV.

J. L. Delgado

Photoactive Phthalocyanine and Subphthalocyanine Containing Carbon Nanostructures

T. Torres

Beyond graphene: Rational synthesis of 2D-polymers

F. Zamora

30.09-04.10.2013

Dresden Summer School on Functional Materials

Patterning of biological and functional materials

I. Rodriguez

10.10.2013

School of Chemistry, University of Hyderabad, Hyderabad, India.

Subphthalocyanines: Singular aromatic non-planar molecules

T. Torres

27-31.10.2013

VI European School on Molecular Nanoscience (ESMoNa 2013), Cuenca, Spain

<http://www.icmol.es/esmolna2013/>

Rational design of 2D-polymers: metal-organic frameworks.

F. Zamora

New functionalities in 2D materials

R. Miranda

Molecular Machines

Emilio M. Pérez

31.10-01.11.2013

Workshop on 2D Materials". Cuenca, Spain

Link: <http://www.icmol.es/2dmaterials/>

06-09.11.2013

X Symposium of Young Chemists RSEQ-Sigma-Aldrich, Madrid, Spain.

Link: <https://www.jiq-rseq.org>



11-14.11.2013

1st Annual Meeting of the European COST Action "XUV/X-ray light and fast ions for ultrafast chemistry (XLIC)", Madrid, Spain

A molecular interferometer to decode attosecond electron-nuclear dynamics. F. Martín

Ultrafast nonadiabatic fragmentation dynamics of biomolecules. M. Alcamí



13-15.11.2013

2nd Annual Workshop of the European ITN Action Correlated Multielectron Dynamics in Intense Light Fields, Madrid. Spain

Link: <http://www.corinf.eu/events/>

3.4. Projects

3.4.1. International programs

ImaginDNA

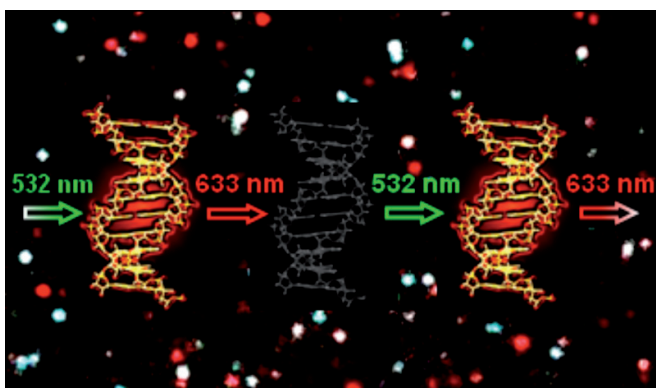
“Advanced DNA imaging: improving spatial resolution and contrast through photoswitching”

Funding: FP7-PEOPLE-2011-CIG n° 303620

Duration: 2013-2017

Principal Investigator: Dr. Cristina Flors

Fluorescence photoswitching constitutes the core of the recently developed “super-resolution” imaging techniques, which are able to improve spatial resolution in fluorescence microscopy beyond the diffraction limit of light. Recent advances in fluorescence photoswitching have also impacted the development of other microscopy techniques such as optical lock-in detection (OLID) imaging. OLID imaging uses fluorescence photoswitching to improve image contrast, instead of spatial resolution. To fully realize the great potential of these advanced imaging methods, novel strategies to label cell components with photoswitchable fluorophores in high density are needed. This project aims at developing new and better ways to engineer fluorescence photoswitching in DNA. Different strategies to introduce desirable properties such as reversible fluorescence photoswitching, high labelling density and control over DNA sequence will be developed throughout the project.



SolarRevolution

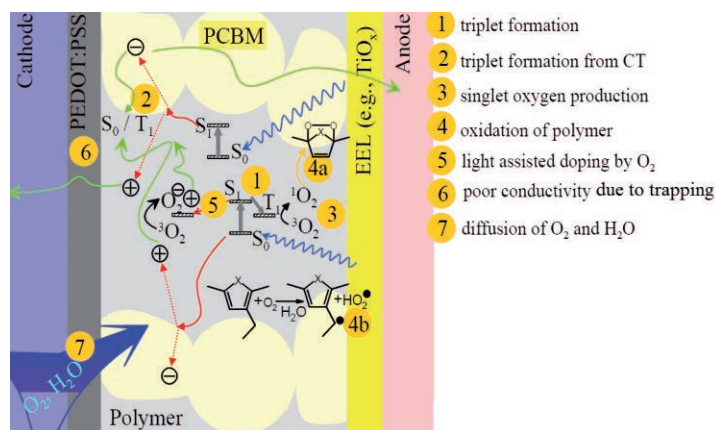
“Revolutionizing Understanding of Organic Solar Cell Degradation to Design Novel Stable Materials”

Funding: FP7-PEOPLE-2012-IEF n° 331795

Duration: 2013-2015

Principal Investigator: Dr. Michael Wykes

SolarRevolution aims to revolutionize the understanding of bulk-heterojunction organic solar cell (OSC) degradation by developing a detailed knowledge of the chemical and physical processes involved. This knowledge will be applied to the rational design of novel materials to give OSCs 20-year lifetimes and allow mass-market uptake of this low-cost, low-energy-footprint, transparent, lightweight and flexible technology. Quantumchemical modelling of degradation mechanisms will provide detailed and experimentally-inaccessible insight. This will dramatically enhance the clarity and robustness of experimental conclusions, leading to a deeper understanding of OSC degradation. Diffusion of oxygen into OSCs and the subsequent photochemical reactions represent the dominant source of degradation of the photoactive layer. Quantum-chemical calculations will characterize the chemical species and photochemical reactions involved in degradation. Semiclassical models will reveal how degraded materials impact exciton and polaron dynamics, and hence OSC efficiency. Finally, our new understanding of degradation will be exploited in the design and in-silico screening of novel materials for stable OSCs. Close collaborative links with leading academic and industrial groups will be forged via host-participation in the pan-European OSC research project ESTABLIS (FP7-ITN-290022). Two-way knowledge-transfer under strict IP control will: i) provide SolarRevolution with state-of-the-art materials and experimental data, and ii) allow hypotheses and novel material designs generated by SolarRevolution to be experimentally verified and industrially trialled. This will ensure that SolarRevolution will be well-positioned to contribute to high-impact publications and patent filings, raising Europe’s profile in OSC research and establishing the fellow, Michael Wykes, as a leading researcher in the field.



XUV/X-ray light and fast ions for ultrafast chemistry (XLIC)

Funding: European Science Foundation. CMST COST Action CM1204

Duration: 2013-2017

Chair of the Action: Manuel Alcamí

The use of novel light sources and fast ions is opening new avenues in the study of chemical reactivity. XUV/X-ray pulses with attosecond duration permit to “visualize” the movement of electrons inside a molecule and a much better control of chemical reactions. X-ray Free Electron Lasers, synchrotrons or collision with fast ions can be used to generate molecules in highly excited and highly charged states that present new and unexpected reactivity.

The study of molecules under these extreme intensities and time resolution conditions requires new theoretical models that can serve as guidance for experiments. The scientific objective of the is to understand, monitor and control the complex ultrafast electronic and nuclear dynamics that occur in medium-sized and large molecules, to develop new control strategies of reactions and to develop a new generation of ultrafast spectroscopies combining attosecond temporal and sub-Angstrom spatial resolutions.

This is an interdisciplinary field in which European groups are very active but work separately. COST is thus the perfect framework to enhance exchange of knowledge, bringing together leading experts in generating, manipulating and modeling these new phenomena. The collaboration between groups will reinforce the European leadership in XUV/X-ray-, attosecond-, synchrotron- and ion-based research in chemistry.

http://www.cost.eu/domains_actions/cmst/Actions/CM1204

NanoSpectroscopy

Funding: European Science Foundation. MPNS COST Action MP1302

Duration: 2013-2017

Participants: Dr. Johannes Gierschner & Dr. Cristina Flors

With today's research and industry aiming for ever smaller objects and feature sizes, there is an increasing demand for spectroscopic methods to investigate processes, objects, and material properties with unprecedented spatial and temporal resolution as well as chemical specificity. The new insights are important for issues such as understanding life on the (sub-)cellular level, light-matter-interaction, light-to-energy conversion, or materials engineering. The interdisciplinary approach of nanospectroscopy encompasses the fields of Physics, (Bio-)Chemistry, Biology, Medicine, Nanotechnology, and Materials Science.

Optical nanospectroscopy uses methods such as confocal and/or ultrafast Raman and fluorescence spectroscopy for the detection and spectral analysis of objects at the nanoscale, down to the single-molecule level. In this Action, nanospectroscopic techniques will be applied to tailored materials and nanostructures (organic/inorganic, semiconducting, metallic, hybrid, bio) to gain deeper understanding of nanoscale processes.

COST NanoSpectroscopy aims at consolidating European expertise on all aspects of UV/Vis/NIR nanospectroscopy (modelling, experiment, nanostructures, materials, equipment, applications) into one coherent Action. The COST networking approach is particularly well suited for this purpose. A training program will be established to spread the know-how of applying nanospectroscopic techniques and the gained insights. In dialogue with European industry, nanospectroscopic techniques will be further developed, e.g. as applied techniques for non-specialists.

http://www.cost.eu/domains_actions/mpns/Actions/MP1302



Understanding and Controlling Nano and Mesoscale Friction

Funding: European Science Foundation. MPNS COST Action MP1303

Duration: 2013-2017

Participants: Dr. Enrico Gnecco

Recent years have seen widespread efforts to understand the mechanisms of friction and tribology in micrometric structures (mesoscale) down to the realm of atoms and molecules (nanoscale) with the ultimate goal of controlling friction, adhesion and wear by design. This research has generated an interdisciplinary scientific area, nanotribology, with great potential impact on technology and everyday life. Applications include safety, economy, life quality, energy and material saving, toward a sustainable development. Europe has a strong scientific nanotribology community spreading over physics, materials science, chemistry, earth and life sciences.

The goal of this COST Action, operating beyond the national horizons, is to mobilize and put together the critical mass of existing human and technical nanotribology resources at a modest price, thus representing a unique opportunity for an efficient scientific investment. IMDEA Nanociencia will have a leading role in this Action, since an IMDEA Senior Researcher, Dr. Enrico Gnecco, will be one of the two Spanish representatives in the Management Committee of the Action. The research topics currently investigated by his group (nanoscale friction in liquid environments, manipulation of nanoparticles by scanning probe microscopy, influence of mechanical vibrations on friction and nanomanipulation, modeling atomic-scale friction and nanomanipulation) will greatly benefit from the interactions which will be established by this project and other groups at IMDEA Nanociencia may join the initiative in the near future.

In summary, the MP1303 COST Action aims to promote conferences, short-term scientific exchanges, training schools and common publications within the 14 countries participating in the project (Austria, Denmark, Finland, France, Germany, Ireland, Israel, Italy, Netherlands, Portugal, Spain, Switzerland, Turkey and United Kingdom). The Action is expected to end in May 2017.

http://www.cost.eu/domains_actions/mpns/Actions/MP1303

NANOPYME

“Nanocrystalline Permanent Magnets Based on Hybrid Metal-Ferrites”

Funding: FP7-NMP-2012-SMALL-6 n° 310516

Partners: Consortium of 11 European partners coordinated by IMDEA Nanociencia

Duration: 2012-2015

Coordinator: Dr. Alberto Bollero

<http://nanopyme-project.eu/>

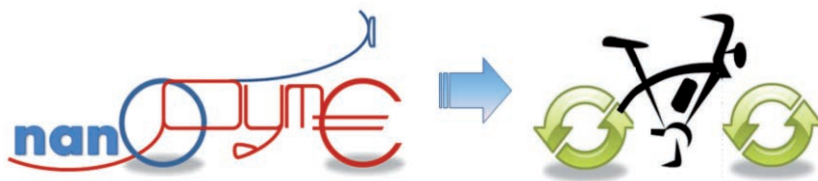


SEVENTH FRAMEWORK
PROGRAMME



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

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



PHOCS

“Photogenerated Hydrogen by Organic Catalytic Systems”

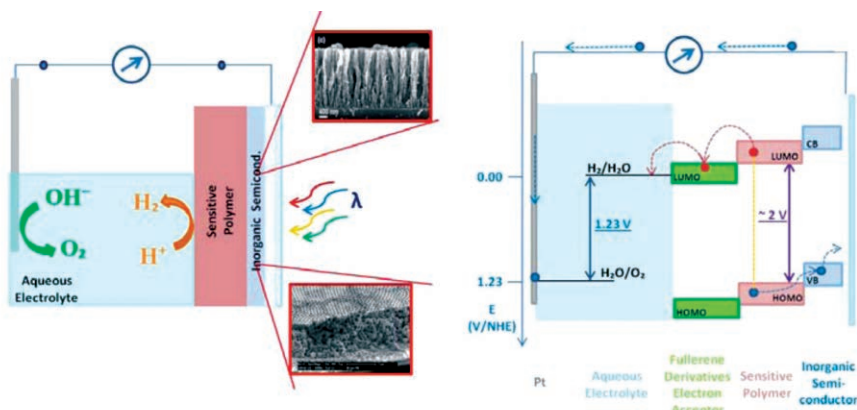
Funding: FP7-ENERGY-2012-1-2STAGE n° 309233

Partners: Consortium of 7 European partners coordinated by the Fondazione Istituto Italiano di Tecnologia, Genova, Italy

Duration: 2012-2015

Principal Investigators: Dr. Nazario Martin & Dr. Juan Luis Delgado

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



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

POCAONTAS

“Polymer-Carbon Nanotubes Active Systems for Photovoltaics”

Funding: FP7-PEOPLE-2012-ITN n° 316633

Partners: Consortium of 9 European partners coordinated by IMDEA Nanociencia.

Duration: 2012-2016

Coordinator: Dr. Larry Luer

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

ESTABLIS

“Ensuring STABlIty in organic Solar cells”

Funding: FP7-PEOPLE-2011-ITN n° 290022

Partners: Consortium of 9 European partners coordinated by the University of Pau and the Pays de L’Adour, France.

Duration: 2012-2015

IMDEA Research Team: Dr. Larry Luer

<http://www.project-establis.eu/>

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

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



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

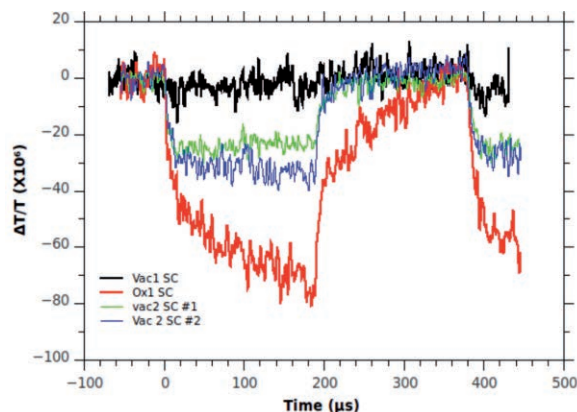


Fig. 1. Optical detection of charge carriers in an organic solar cell under short circuit (SC) conditions via their induced absorption (negative differential transmission, $\Delta T/T$, at 980nm. A highly efficient pristine solar cell (black curve) does not accumulate charges at all, because of efficient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



European Research Council
 Established by the European Commission

MINT

“Mechanically Interlocked Carbon Nanotubes”

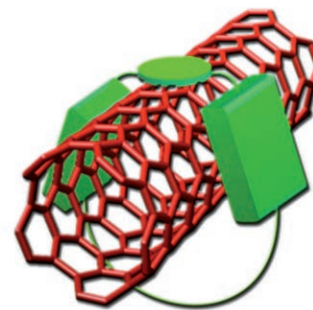
Funding: ERC-2012-StG_20111012 n° 307609

Duration: 2012-2017

Principal Investigator: Dr. Emilio Pérez

We present a plan to design, synthesize and exploit the properties of mechanically interlocked carbon nanotubes (MINTs). The scientific aim of the project is to introduce the mechanical bond as a new tool for the derivatization of carbon nanotubes. The mechanical link combines the advantages of covalent and supramolecular modifications, namely: kinetic stability (covalent) and conserved chemical structure (supramolecular). Besides this, its dynamic nature opens up unique opportunities for both fundamental studies and applications. From a technological point of view, MINTs should have a practical impact in the fields of molecular electronics and molecular machinery. A general

modular approach to MINT-based materials for photovoltaic devices and electrochemical sensors is presented. We also expect to exploit the rigidity and low dimensionality of SWNTs to construct molecular machines that utilize them as tracks to move across long distances, which is not possible in small-molecule molecular machines. To achieve these goals we will exploit the PI's expertise in the chemical modification of carbon nanostructures, the self-assembly of electroactive materials and the synthesis and characterization of mechanically interlocked molecules.



NANOTEST

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

Funding: FP7-PEOPLE-2010-IOF n° 275148

Duration: 2012-2015

Principal Investigator: Dr. Ramses V. Martinez

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

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

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



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

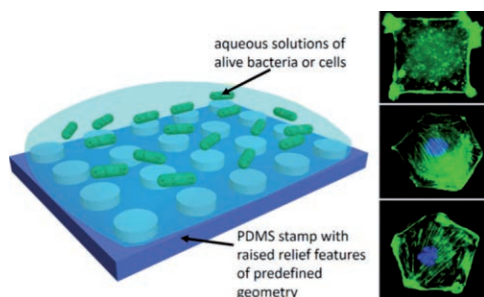


Figure 1. Left: Method for the patterning alive bacteria or cells using micro-contact printing. Right: Confocal microscope images showing the control on the shape of the printed cells. Each cell has a surface of approximately $900 \mu\text{m}^2$. Images obtained by fluorescence microscopy of cells confined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



Organic position sensitive photodetectors

Funding: Chinese Scholarship Council Call 2011

Duration: 2012-2016

Principal Investigators: Dr. Juan Cabanillas, Dr. Feng Luo, Dr. Miguel Angel Niño & Dr. Paolo Perna

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

[1] J. Cabanillas-Gonzalez and M. Campoy-Quiles, *PCT/ES2011/070841*.

[2] J. Cabanillas-Gonzalez et al., *Appl. Phys. Lett.* 99, 103305 (2011).

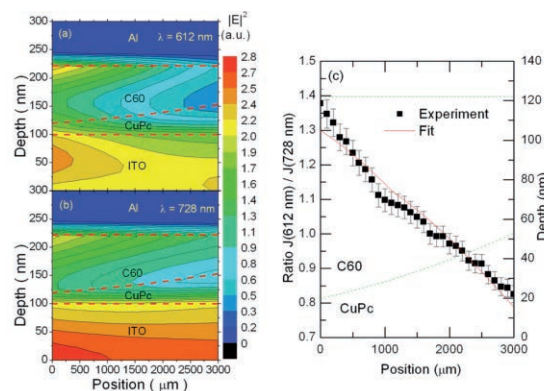


Figure. (Left) Optical modelling of the in-depth distribution of light across a multilayer photodetector. (Right) Dependence of photocurrent as a function of position.

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



Funding: Chinese Scholarship Council Call 2011

Duration: 2012-2016

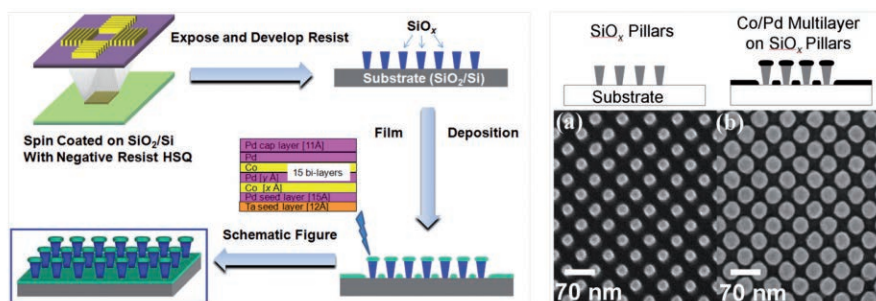
Principal Investigator: Dr. Feng Luo

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

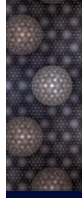
[1] F. Luo, L.J. Heyderman, H.H. Solak, T. Thomson, and M.E. Best, *Appl. Phys. Lett.* 92, 102505 (2008).

[2] P. Kanberberger, F. Luo*, et al, *Applied Physics Letters*, 95, 023116 (2009).

[3] F. Luo*, et al, *J. Nanosci. Nanotechnol.*, 12, 2484 (2012).



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



Other research projects currently running at IMDEA Nanociencia Institute are:

MULTIFUn

“MultiFunctional Nanotechnology for Selective Detection and Treatment of Cancer”

Funding: FP7-NMP-2010-LARGE-4 n° 262943-2

Partners: Consortium of 16 European partners coordinated by ATOS Origin and IMDEA Nanociencia (Scientific coordination)

Duration: 2011-2015

Principal Investigators: Dr. Rodolfo Miranda, Dr. Francisco Terán, Dr. Aitziber López-Cortajarena & Dr. A. Somoza

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

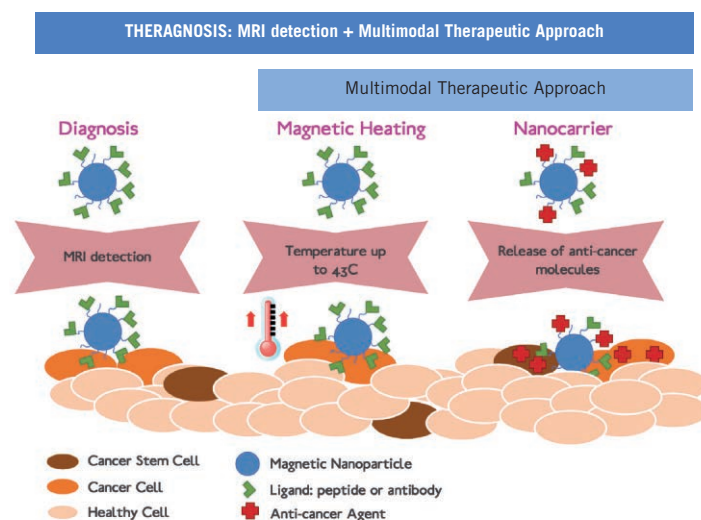


Figure 1:
schematic
representation of
the MNP
functionalities
related to the
theragnostic
approach.

MAMA

“Unlocking research potential for multifunctional advanced materials and nanoscale phenomena”

Funding: FP7-REGPOT-2010-1 n° 264098

Partners: Consortium of 11 European partners coordinated by the CNR-SPIN, Italy

Duration: 2010 -2014

Principal Investigators: Dr. Rodolfo Miranda & Dr. Paolo Perna

<http://mama.spin.cnr.it/>



Multifunctional materials are defined as those materials that perform specific functions other than possessing a load bearing capacity. Examples include semiconductors, magnetic materials, piezoelectric and ionic conductors. In this context, transition metal oxides (TMOs) have been attracting an ever-increasing interest, due to the wide variety of physical properties that they exhibit, including unconventional superconductivity, piezo- and ferroelectricity, colossal magneto-resistance, multi-ferroicity and a number of exotic magnetic, charge and orbital orderings. Still, the analysis and modelling of hybrid heterostructures, where layers of functional organic materials represent an ultimate and even more ambitious challenge. Such features are believed to open the route to the fabrication of device prototypes where multiple functionalities of TMOs and functional organic layers are nano-integrated on the same chip. The range of application sectors is correspondingly large, including: information and communications technology, energy generation, storage and transport. Within the project the CNR-SPIN Campania aims at unlocking its research potential to face the scientific challenge behind the complexity of multifunctional advanced materials and nano-scale phenomena. By exploiting the available partnerships expertises and experimental endowment, complemented by the new resources provided within the project, the CNR-SPIN Campania aims at achieving the highest level of competitiveness about issues of i) materials fabrication, by addressing the growth of very high quality samples in the different shapes of epitaxial thin films and single crystals, also integrated together in complex hetero-structures and; ii) advanced material characterizations, both based on matter-light interaction, on scanning probe techniques and on electron-magnetic transport, iii) theoretical modelling and advanced multi-scale computation to analyze and get insight into different physical properties of innovative materials.



ONDA

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

Funding: FP7-PEOPLE-2009-IRSES n° 247518.

Partners: Consortium of 7 European partners coordinated by the University of Modena and Reggio Emilia (Italy) and IMDEA Nanociencia (Scientific coordination)

Duration: 2010-2014

Principal Investigators: Dr. Rodolfo Miranda & Dr. Julio Camarero

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

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

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

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

BIONANOTOOLS

“Protein design to generate bio-functional nanostructures”

Funding: FP7-PEOPLE-2009-IRG n° 246688

Duration: 2010-2014

Principal Investigators: Dr. Aitziber López-Cortajarena

The main objective of this is to understand how the structure and function of proteins are defined by their sequence and to apply learned rules to design new protein-based nanotools. In particular, focuses on a type of proteins called tetratricopeptide repeats

(TPR). They present a simple modular structure, where a small structural unit is repeated in tandem. Overall TPR domains are a very robust system to study protein structure, folding, and function, and to use them as building blocks for protein engineering to generate new functional nano-molecules.

We design functional proteins with defined binding-specificities and structural properties. These novel bio-tools will be extremely useful to monitor and investigate biological processes in vivo, as biosensors for diagnosis to detect disease biomarkers, and also as building blocks for applications in biomaterials design.

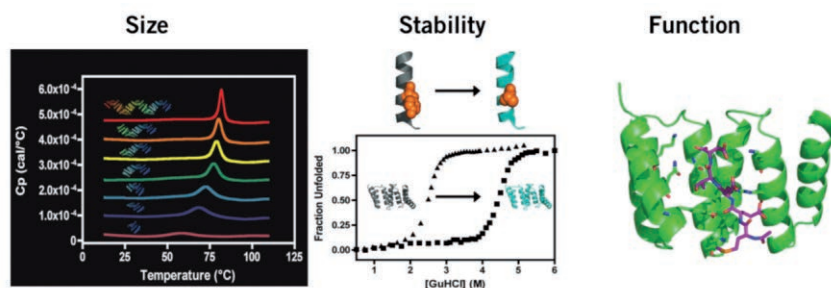


Fig 1. Bionanotools generation. Protein design for generation of tailored properties and modification of size, stability and function.

MRLSMO

“LSMO based magnetoresistive sensors”

Funding: CNRS Projet de coopération PICS 2012 France / Espagne N° Système: 157683

Duration: 2012-2014

Principal Investigator: Dr. Paolo Perna

The MRLSMO project is a cooperation project financed by the CNRS that focuses on the fabrication and characterization of half metallic perovskitic oxide $\text{La}_{0.7}\text{Sr}_{0.3}\text{MnO}_3$ (LSMO) based magnetoresistive sensors. The project is established between the GREYC (CNRS-UMR 6072) laboratory and the Nanomagnetism's group at IMDEA Nanociencia Institute. With the aim of optimizing the magnetoresistive performances of the LSMO-based structures, we plan to investigate all the aspects concerning the fabrication of devices, i.e. thin film deposition and photolithography, structural characterization of materials, study of the magnetic properties (magnetic anisotropy), magnetoresistance and noise measurements.

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

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

3.4.2. National programs

PROBIOMAT

“Tailored protein biomaterials” “Biomateriales a la Carta”

Funding: Spanish Ministry of Science and Innovation (Fundamental Research Programme) BIO. 2012-34835

Duration: 2013-2015

Principal Investigator: Dr. Aitziber López-Cortajarena.

The precise synthesis of materials with tailored properties it is a requisite for their use in nanotechnology and medicine. Bottom-up self-assembly that relies on molecular interactions of small defined components, is an attractive approach for biomaterial design and nanostructure templating.

In this project we use self-assembling proteins to generate templates for nanofabrication and biomaterials. We aim to rationally assemble biocompatible functional materials by the combination of simple protein building blocks with specified properties. In order to develop rational approaches for the design of complex nanostructures, we will define sequence-structure-assembly relationships for model designed repeat protein. We will then synthesize new protein molecules with unique assembly properties to generate higher order structures with desired properties and geometries.

This project is based on the deep molecular understanding of the components in order to combine them to generate nanostructures with defined properties.

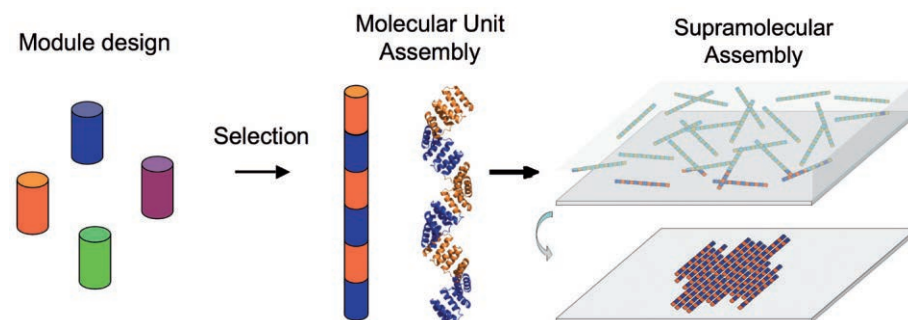


Fig 1. Schematic representation of bottom-up approach for engineering novel functional assemblies.

EFISOL

“Synthesis and Design of new sensitizers for the preparation of more efficient DSSC”

Funding: Spanish Ministry of Science and Innovation (Fundamental Research Programme) CTQ2012-30668

Duration: 2013

Principal Investigator: Dr. Juan Luis Delgado

In this project a number of strategies have been proposed for the improvement of all the fragments within the Donor- π -conjugated bridge-Acceptor scheme.

To this end, as first activity, we propose the introduction of light harvesting units, such as oligomers of thiophene or multichromophoric fragments, in order to improve the absorption properties of the donor unit. The second and third activities deal with the structural modification of the acceptor fragment and the bridge, to achieve a better electronic communication between the donor and the acceptor units.

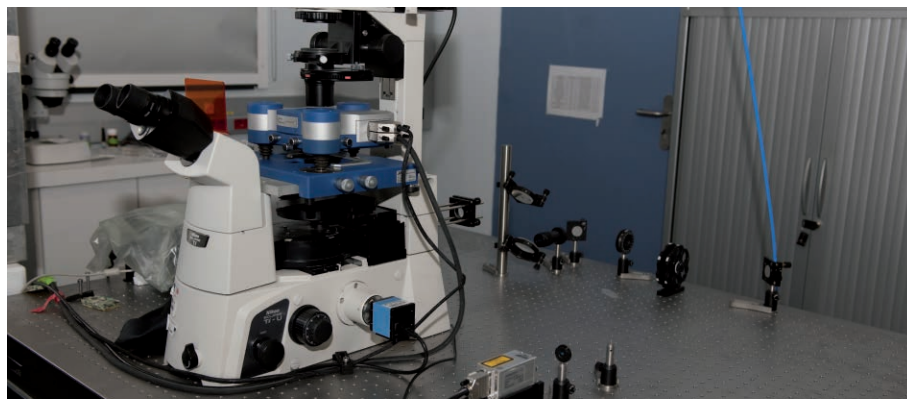
Finally, the last activity describes the utilization of quantum dots as sensitizers to prepare DSSC. Through suitable control of the size we expect to control the absorption properties of the QD, and therefore increase the efficiency of the devices.

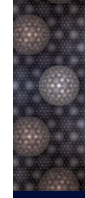
As an example of applications currently based on this technology, the company G24i started the commercialization of the “Grätzel solar bag”, able to power small electronic devices such as cell phones. It is important to note however that this technology is currently under research in order to improve the stability and price of the final devices. ¹



“Grätzel solar bag” prepared by G24i.

¹ <http://www.g24i.com/news,g24i-ships-worlds-first-commercial-application-of-dssc,173.html>





ColQDMol

“Colloidal Semiconducting Quantum Dot Molecules Studied by Scanning Tunneling Spectroscopy and Tunneling Current-Induced Luminescence”

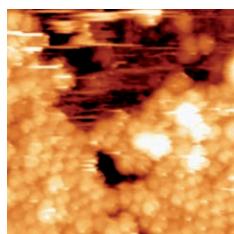
“Moléculas de puntos cuánticos semiconductores coloidales estudiadas mediante espectroscopia tunel de barrido y luminiscencia inducida por la corriente túnel.”

Funding: Spanish Ministry of Science and Innovation (Fundamental Research Programme) FIS2012-33011

Duration: 2013-2015

Principal Investigator: Dr. Roberto Otero

The aim of this project is to fabricate molecules of colloidal semiconductor quantum dots (QDs) on graphitic surfaces, and the investigation of their electronic and optical properties with a Scanning Tunneling Microscope operated at cryogenic temperatures. Most of the previous studies on QD molecules have been carried out on epitaxially grown nanostructures. For these systems, the control over the possible geometries for the quantum dots is limited and they are very sensitive to atmospheric exposure. Colloidal QDs, on the contrary, are much more stable under ambient conditions, due to the



surface passivation provided by the organic ligand shell, and their lateral position on a solid surface can be controlled very precisely by means of STM manipulations. While spectroscopy with the STM should give us information about the change of the electronic levels due to the presence of neighboring QDs, the optical coupling can be studied through the luminescence induced by the tunneling current.

STM image (41 nm x 41 nm, $V_t = 3700$ mV; $I_t = 10$ pA) showing a close-packed array of CdSe QDs on a HOPG surface

FASAMEX

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

Funding: Spanish Ministry of Science and Innovation (Fundamental Research Programme) MAT2012-38810 & MAT2011-26312

Duration: 2013-2015

Principal Investigator: Dr. Enrico Gnecco.

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

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

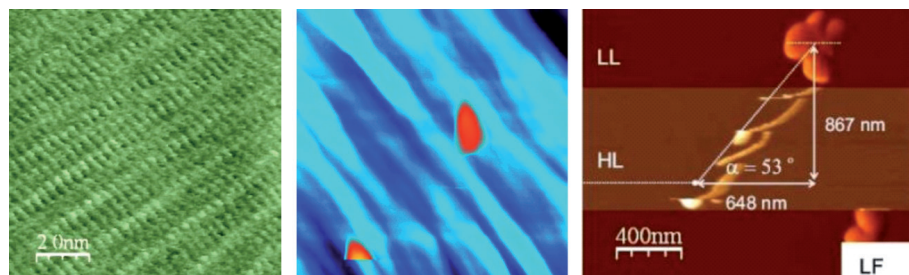


Fig. 1. Friction force map of CuPc molecules on dolomite (104) in water; Fig. 2. Detachment of a calcite island from a kutnahorite substrate; Fig. 3. AFM manipulation of Sb islands on a MoS₂ substrate.

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

DNA-COMPASS

“Super-resolution microscopy of DNA: optimization through correlative microscopy and spectroscopy”

“Microscopia de super-resolución de ADN: optimización a través de microscopia correlativa y espectroscopia”

Funding: Spanish Ministry of Science and Innovation (Fundamental Research Programme) MAT2012-34487

Duration: 2013-2015

Principal Investigator: Dr. Cristina Flors

This project will use two complementary tools to further develop super-resolution imaging of DNA. First, a novel correlative super-resolution fluorescence/atomic force microscope will be implemented. DNA nanostructures of controllable size and shape labelled with DNA-binding dyes will be used as test samples and imaged using the novel setup. The ability to correlate super-resolution and topography will be crucial to optimize the performance of the dyes, characterize undesired distortions of DNA structure, and identify possible super-resolution imaging artefacts. In addition, since the control of the photophysics of the dye/DNA complexes is crucial to improve the achievable spatial resolution, a combination of



ensemble and single-molecule spectroscopic measurements will be used to study these complexes. This will allow us to understand important processes such as photoblinking. Finally, the improved protocols for super-resolution imaging will be used to study DNA nanostructure in cells.

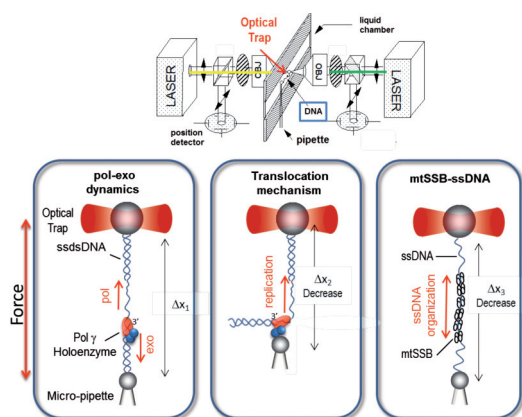
DNAdyn

“Single molecule studies of the mitochondrial DNA replication dynamics”

Funding: Spanish Ministry of Science and Innovation (Fundamental Research Programme). BFU2012-31825

Duration: 2013-2015

Principal Investigator: Dr. Borja Ibarra.



Mitochondria are the energy-producing organelle in animals, and mitochondrial function impacts nearly every aspect of cellular function, being critical for life. A full understanding of the mitochondrial function is in need for an in-depth characterization of the mechanochemical processes that govern the operation of the molecular motors involved in the replication of the mitochondrial DNA. We propose to employ a combined approach of biochemistry, structural biology, and single molecule biophysics involving optical tweezers, to study the dynamical and mechanochemical principles responsible for the activity of the proteins involved in the replication of the human mitochondrial DNA. The long-term objective of our research is the elucidation of the mechanism of DNA replication in animal mitochondria, and its relationship to mitochondrial mutagenesis and human disease.

SIESPER

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

Funding: Spanish Ministry of Science and Innovation (Fundamental Research Programme). MAT2011-25598.

Duration: 2012-2014

Principal Investigator: Dr. Alberto Bollero

Advances from Materials Science, Physics and Engineering have led to dramatic improvements in information technology applications (hard disks, magnetic memories, sen-

sors,...). In particular, an important effort has been done along the last decades by scientific and industrial research groups to increase the magnetic memory storage density through further miniaturization of devices.

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

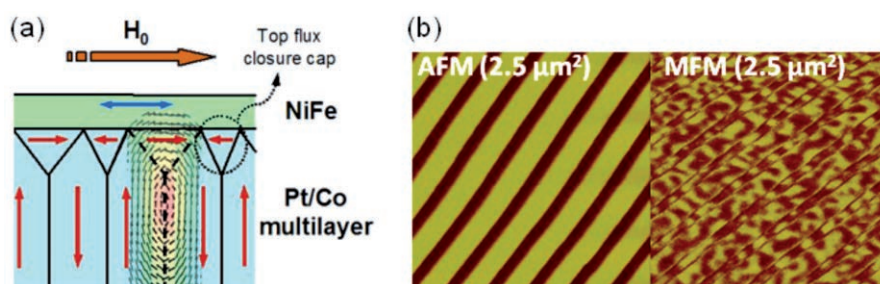


Figure. (a) Unequal closure domains configuration responsible of the phenomenon of exchange-bias observed in a ferromagnetic-ferromagnetic bilayer. (b) AFM (left) and MFM (right) images showing the topography and magnetic domain configuration, respectively, for nanostructures (lines) of the magnetic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

CONMOL

“Tailor-made Conjugated Molecular Materials via Intra- and Intermolecular Control”

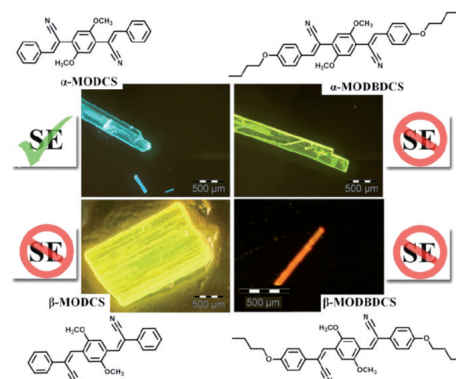
Funding: Spanish Ministry of Science and Innovation (Fundamental Research Programme). CTQ2011-27317.

Duration: 2012-2014

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

The rational design of conjugated organic materials for optoelectronics with defined electronic, optical and photophysical properties in the solid state suffers from the complex interplay of intra- and intermolecular contributions, and from disorder usually found in polymeric samples. CONMOL thus explore structurally and electronically well-defined oligomeric materials forming single

Stimulated Emission (SE) in Color-tuned Single Crystals



crystals. Experimental photophysical studies, hand-in-hand with advanced structural characterization and quantum-chemical calculations provide an in-depth understanding of solid state exciton signatures and their fate, and how this ultimately controls the emissive and multi-stimuli response in organic materials. This opens the path towards the design of supramolecular assemblies through specific secondary forces for bright emissive, color-tunable organic crystals, showing superior lasing, sensing, or charge transport properties.

SIMMA

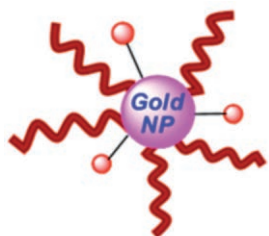
Synthesis of Advanced Molecular Machinery

Funding: Spanish Ministry of Science and Innovation (Fundamental Research Programme). CTQ2011-25714.

Duration: 2012-2014

Principal Investigator: Dr. Emilio Pérez

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



NanoOligo

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

Funding: Spanish Ministry of Science and Innovation (Fundamental Research Programme). SAF2010-15440.

Duration: 2011-2013

Principal Investigator: Dr. Álvaro Somoza

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

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

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

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

POLYDYE

“Conjugated polymer based optical amplifiers for chemical sensing”

Funding: Spanish Ministry of Science and Innovation (Fundamental Research Programme). TEC2010-21830-C02-02.

Duration: 2011-2013

Principal Investigator: Dr. Juan Cabanillas

Conjugated polymers have several properties which makes them highly suitable for optical sensing. Examples are high photoluminescence quantum yield in solid state, notable optical gain properties, exciton diffusion lengths exceeding 10 nm and ease of processing into waveguides and laser resonators. Exploiting ASE emission of conjugated polymers in waveguides for sensing has the advantage of increasing the sensitivity to fluorescence quenchers compared to conventional fluorescent sensors since non linear emission is dramatically reduced by their presence at the polymer surface. In this project we develop rib planar waveguides based on polyfluorene with widths comprised between 20 and 200 μm and 800 nm height. Typical analytes targeted are NO_2 and amines. Capping of the polymer waveguide with monolayers of photoactive molecules is investigated as a way to fine tune the sensitivity and selectivity of the waveguide sensor.

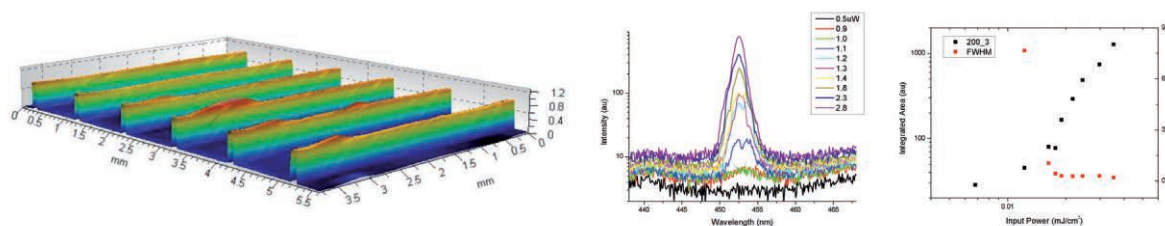


Figure (from left to right): Topography image of 100 μm waveguide ribs. ASE emission characteristics as a function of excitation fluence.

NANOBIOMAGNET

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

Funding: Programas de Actividades de I+D entre grupos de investigación de la Comunidad de Madrid. S2009/MAT-1726

Duration: 2010-2013

Principal Investigator: Dr. Rodolfo Miranda

www.nanobiomagnet.es

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

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

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



MADRISOLAR2

“Photo-and Electroactive materials for organic and hybrid solar cells”

Funding: Programas de Actividades de I+D entre grupos de investigación de la Comunidad de Madrid. S2009/MAT-1726

Duration: 2010-2013

Principal Investigator: Dr. Nazario Martín

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

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

NOBIMAT-M

“New materials and hybrid biofunctional devices in Nanoscience”

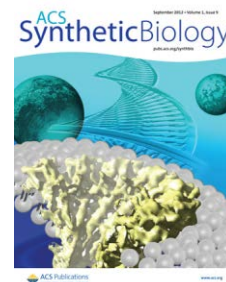
Funding: Programas de Actividades de I+D entre grupos de investigación de la Comunidad de Madrid. S2009 / MAT-1507.

Duration: 2010-2013

Principal Investigator: Dr. J.López Carrascosa

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

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



NANOMADRID

Know Science Today Opens the Future's Doors

Funding: FECYT

Duration: 2012-2013

www.nanomadrid.es



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

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

3.4.3. Companies



Aernnova and Deimos Space (Perigeo Consortium)

- Graphene pasivation of planetary atmospheric entry shields



Abengoa Research

- Conductive Printable Graphene Inks
- 2D-COF Water Desalinization



HM Hospitals and Roche Pharma

- Nanoparticles for Glioblastoma Multiforme

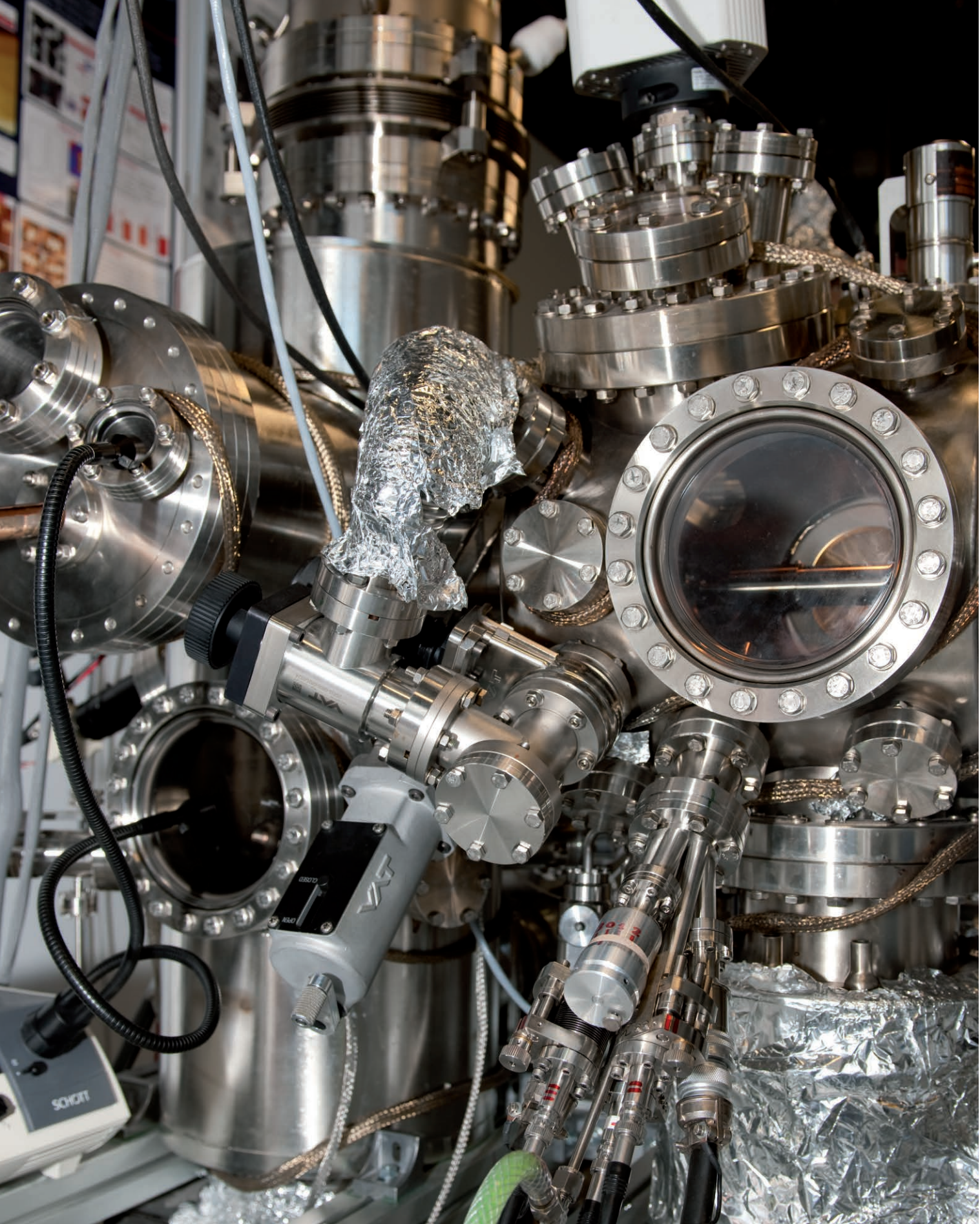


Fundación para la Investigación Biomédica
del Hospital Universitario Ramón y Cajal



Laboratorios Rubió and Hospital RyC

- Prove of Concept siRNA Renal Failure Predictor Test



3.5. Fellowships and internships

3.5.1. Fellowship

7FP Marie Curie Action. AMAROUT I

(until 1st March 2013, end of the project)

Incoming Fellowships

Call 2012

Dr. Cristina Flors, Dr. Pawel Nita, Dr. Marta Mroz, Dr. Koen Lauwaet

Call 2011

Dr. Fabián Calleja, Dr. Miguel Angel Niño, Dr. Shinto Varghese

Call 2010

Dr. Enrico Gnecco, Dr. Feng Luo

Call 2009

Dr. Paolo Perna, Dr. Larry Luer

7FP Marie Curie Action. AMAROUT II

(since 1st October 2012, start of the project)

Incoming Fellowships

Call 2013

Daniel Ortega

Call 2012

Ismail Hijazi (until June 2013)

Reintegration Fellowships

Dr. Isabel Rodríguez

Spanish Ministry of Science and Innovation

Ramon y Cajal Programme

Call 2011

Dr. Francisco Terán, Dr. Cristina Flors, Dr. Begoña Sot

Call 2009

Dr. Larry Luer, Dr. Juan Cabanillas

Call 2008

Dr. Emilio Pérez, Dr. Juan Luis Delgado (until December 2013), Dr. Teresa González

Call 2007

Dr. Johannes Giershner (until January 2013), Dr. Ricardo Arias, Dr. Alberto Bollero (until February 2013)

Juan de la Cierva Programme

Call 2011

Dr. Paolo Perna

Technical Support Specialist Programme

Call 2013

Rebeca Amaro

Call 2011

Dr. Santiago Casado

Spanish Ministry of Education

FPU Programme. Predoctoral Grant

Call 2011

Macarena Calero

Chinese Scholarship Council

Call 2012

Junqing Shi. "Supramolecular Nanostructured Multi-Chromophore Materials". Four years PhD fellowship

Call 2011

Longfei Wu. "Organic position sensitive photo-detectors". Four years PhD fellowship

Hauyu Feng. "Multilevel magnetic recording in bit patterned media for areal densities above 5 Terabit-per-square-inch" Four years PhD fellowship

3.5.2. Internships

D. Cosme González

"Experimental set-up of an singel organic molecules in ultra high vacuum" Universidad Autónoma de Madrid, Spain.

D. Sergio Adán

"Protein-oligonucleotide hybrids in nanotechnology" Universidad Autónoma de Madrid, Spain.

D. Manuel Cuesta

"Software development for time resolved optical spectroscopy" Universidad Politecnica de Madrid, Spain

D. Fernando Cerrón

"Understanding mechano-chemical processes at the nanoscale one molecule at a time" Universidad Complutense de Madrid, Spain.

D. Pedro Lara

"Biophysical applications of DNA nanoparticles" Universidad Autónoma de Madrid, Spain.

D. Alberto Martín

"Experimental set-up of an optically accessible STM" Universidad Autónoma de Madrid, Spain.

Dña. Laura Rincón

"Electronic transport in tunable molecular junctions on graphene sheets" Universidad Autónoma de Madrid, Spain.

D. David Rodríguez

"Post-functionalization of laminar covalent organic frameworks: Studies of properties." Universidad Autónoma de Madrid, Spain.

D. Fernando Jiménez

"Protein-oligonucleotide hybrids in nanotechnology" Universidad Autónoma de Madrid, Spain.

internships



3.6. Institutional activities

07/02/2013

Cooperation agreement signed by IMDEA Nanoscience and HM Hospitales Foundation



17/05/2013

Prof. Rodolfo Miranda opens the Conference Series "Energy Times" organized by Repsol



21/02/2013

Prof. Rodolfo Miranda's appearance in The Senate



21/05/2013

Prof. Fernando Martín: Lecture at the Royal Spanish Academy of Sciences

24/10/2013

Organizer of the visit of the Atletico de Madrid Medical Commission

28/11/2013

Co-organizer of the visit of the representative of FAN (Fundación Argentina de Nanotecnología)

07/03/2013

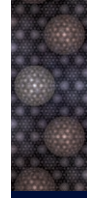
Host Institution and co-organizer of the visit of the Science & Technology Commission of Morocco

12/03/2013

Prof. Rodolfo Miranda: Lecture at the Royal Spanish Academy of Sciences

09/04/2013

Host Institution and co-organizer of the visit of the Science & Technology Commission of Poland



3.7. Academic activities

3.7.1. Theses

14-01-2013

Caracterización de la terminasa mayor del bacteriófago T7.

María Ibarra Daudén

Supervisors: José L. Carrascosa y Jaime Martín-Benito

15-02-2013

Bases estructurales de la cápsida del virus de la bursitis infecciosa para el desarrollo de futuras aplicaciones biotecnológicas.

Elena Pascual Vega

Supervisors: José L. Carrascosa y José Ruiz Castón

25.06.2013

Cambios estructurales implicados en la maduración de la cápsida del bacteriófago T7.

Alina Elena Ionel

Supervisors: José L. Carrascosa y Jaime Martín-Benito

16.07.2013

Surface chemistry of colloidal semiconductor quantum dots on graphitic substrates

Fabiola Iacono

Supervisors: Roberto Otero and Beatriz H. Juárez

19.07.2013

Self-Assembly, Study and Applications of Metallosupramolecular Capsules based on Subphthalocyanines

Irene Sánchez-Molina Santos

Supervisors: Tomás Torres y Christian G. Claessens Autónoma de Madrid

22.07.2013

Electron acceptor molecules deposited on epitaxial graphene studied by means of low temperature scanning tunnelling microscopy/spectroscopy

Manuela Garnica Alonso

Supervisors: Amadeo L. Vázquez de Parga and Rodolfo Miranda

13.09.2013

Síntesis y Caracterización de Nanomateriales OD, 1D y 2D

Isadora Berlanga

Supervisors: Félix Zamora y Rubén Mas

17.09.2013

Transferencia Electrónica Fotoinducida en díadas y triadas electroactivas derivadas de mono y dímeros de fullerenos

Carmen Villegas Jimenez

Supervisors: Nazario Martín and Juan Luis Delgado

academic
activities

27.09.2013

Caracterización biofísica de complejos replicativos de DNA a nivel de moléculas individuales.

Jose A Morín

Supervisors: Borja Ibarra, José L. Carrascosa

30.09.2013

Magnetic Control of Superconducting Vortices

Alicia Gomez

Supervisors: M.E. González, José Luis Vicent

30.09.2013

High affinity ex-TTF based receptors for fullerenes

Helena Isla

Supervisors: Nazario Martín and Emilio M. Pérez

04.10.2013

Charge transfer between organic molecules and epitaxial graphene on metals"

Daniele Stradi

Supervisors: Fernando Martín, Cristina Díaz

Blanco

3.7.2. Master Thesis

June.2013

Medida de la estabilidad de una (o varias) uniones moleculares de OPE-diamina

Adrián Díaz Álvarez

Supervisors: M.T. González, Nicolas Agrait

June.2013

A study of the sequence influence in the elastic response of dsDNA and dsRNA

Irene Gutiérrez Pérez

Supervisor: J. Ricardo Arias-González

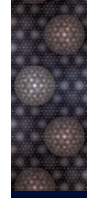
July.2013

Theoretical study on the fragmentation dynamics of L-alanine

Estefanía Rossich Molina

Supervisor: Yang Wang





3.8. Participation in Courses, Seminars and Conferences

24.01.2013

Universidad de Würzburg , Würzburg, Alemania

Supramolecular Chemistry of Carbon Nanostructures: Concave-convex Interactions

N. Martin

01.02.2013

Annual Workshop of CPST Vilnius, Lithuania

Transient absorption spectroscopy in excitonically coupled systems: enhancing the spectral selectivity

L. Lüler

28.02.2013

Instituto de Cerámica y Vidrio – CSIC Madrid

Electrical properties and stability of single-molecule junctions formed with a scanning tunneling microscope in ambient conditions

T. Gonzalez

05.03.2013

Facultad de Ciencias Físicas, U. Complutense de Madrid, Spain

DNA polymerase: a Maxwell's demon that replicates genetic information

J. Ricardo Arias-Gonzalez

06.03.2013

Universidad de Tokyo, Tokyo, Japón

Asymmetric Synthesis of Fullerenes

N. Martin

11.03.2013

Instituto de Ciencia Molecular

Fullerenes for Biological Applications

N. Martin

14.03.2013

Instituto de Ciencia de Materiales de Madrid – CSIC Madrid

Electrical properties and stability of single-molecule junctions formed with a scanning tunneling microscope in ambient conditions

T. Gonzalez

18.03.2013

Facultad de Química, Universidad de Erlangen, Erlangen, Alemania

Organic Molecular Wires

N. Martin

22.04.2013

Instituto de Ciencias Fotónicas de Cataluña, Barcelona, Spain

XUV/X-ray femto- and attosecond laser pulses for ultrafast electronic control in chemistry

F. Martín

seminars, courses
and conferences

17.05. 2013

Department of Chemical Engineering & Applied Chemistry, University of Toronto, Toronto, Canada

Phthalocyanines: old dyes, new molecular materials

T.Torres

20.05. 2013

Department of Chemistry & Biochemistry at Hunter College of the City University of New York (CUNY), New York, USA

Phthalocyanines: old dyes, new molecular materials

T.Torres

28.05.2013

Physics Institute at University at Sao Carlos, Brazil

Enhancing the efficiency and stability of organic solar cells,

L. Lüer

31.05.2013

Department of Chemistry, University of Sherbrooke, Canada

Exciton Signatures and Fates in Conjugated Organic Materials

J. Gierschner

20.07.2013

National University Singapore, Singapore

Lego Chemistry for the rational design of 2D-polymers

F. Zamora

23.08.2013

IMRE, Singapore

Beyond graphene: Rational synthesis of 2D-polymers

F. Zamora

22-26.07.2013

Universidad de Málaga, Spain

Curso de Verano "Virus y Enfermedades" de la Universidad de Málaga. Estructuras Virales

J.L. Carrascosa

04-06.09.2013

Frontiers of Modelling Excited States of Materials Workshop, Chicheley Hall, United Kingdom

"Modeling of Optical Properties of Conjugated Oligomers & (Co)Polymers - Concepts and Methods"

M. Wykes

"Herzberg-Teller Intensity Borrowing in a Conjugated Porphyrin Nanoring"

M. Wykes

24.09.2013

Shandong University, China

Nanomagnets for ultra-high density magnetic recording media

Feng Luo

08.10.2013

Department of Chemistry, Indian Institute of Technology, IITB, Mumbai, India.

Phthalocyanines: old dyes, new molecular materials

T.Torres

10.10.2013

IICT-NIMS Center, CSIR-Indian Institute of Chemical Technology, Hyderabad, India.

Phthalocyanines: old dyes, new molecular materials

T.Torres

15.10.2013

Max Planck Institute, Mainz, Alemania

Designing efficient receptors for carbon nanoforms

N. Martin

15.10.2013

CSIR-National Institute for Interdisciplinary Science and Technology (CSIR-NIIST), Thiruvananthapuram, India.

Phthalocyanines: old dyes, new molecular materials

T.Torres

16/10/2013

Tübingen University, Tübingen, Alemania

Concave-convex Supramolecular Interactions:
Electroactive Molecular Receptors for Carbon
Nanostructures

N. Martin

24.10.2013

Ulm University, Ulm, Alemania

Concave-convex Electroactive Receptors for Car-
bon Nanostructures

N. Martin

04-06.11.2013

Kansas State University, Manhattan, USA

A molecular interferometer to decode electron
and nuclear dynamics in attosecond XUV pump-
probe spectroscopy

F. Martín

You Tube: <http://goo.gl/uAJgsf>

07.10.2013

**Workshop on Nanocarbon Optics, Knottenried,
Germany**

Target analysis: Photoexcitation dynamics in
Carbon Nanotubes,

L. Lürer

07-10.11.2013

**5th Consortium Meeting of MultiFun project, Paris,
France**

Multifunctionalization strategies of iron oxide
nanoparticles

Pierre Couleaud

14.11.2013

**Laboratory for Chemistry of Novel Materials, Mons,
Belgium**

Luminescent Crystalline Conjugated Com-
pounds: Tuning of the Optical and Photophy-
sical Properties

J. Gierschner

22.11.2013

**Department of Materials Science and Engineering,
Seoul National University, South Korea**

Organic Single Crystal Lasers

J. Gierschner

28. & 29.11.2013

**Department of Materials Science and Engineering,
Seoul National University, South Korea**

Practical Aspects of Optical Spectroscopy -
Tricks and Traps

J. Gierschner

02.12.2013

**Department of Chemistry, M. V. Lomonosov Moscow
State University, Moscow, Russia**

Phthalocyanines and analogues as components of
photovoltaic and artificial photosynthetic devices

T.Torres

04.12.2013

**Department of Fine Organic Synthesis, Ivanovo
State University of Chemistry and Technology,
Ivanovo, Russia**

Phthalocyanines and analogues as components of
photovoltaic and artificial photosynthetic devices

T.Torres

05.12.2013

**Research Institute of Macroheterocyclic Com-
pounds, Ivanovo State University of Chemistry and
Technology, Ivanovo, Russia.**

Subphthalocyanines: Singular aromatic non-
planar molecules

T.Torres

09.12.2013

Université de Namur, Namur, Bélgica

Chiral Fullerenes from Asymmetric Catalysis

N. Martin

10.12.2013

**Institute für Organische Chemie, Erlangen Univer-
sity, Erlangen, Alemania**

Designing Efficient Receptors for Carbon Nano-
forms

N. Martin

16.12.2013

Technische Universität Berlin, Berlin, Germany.

Phthalocyanines: Old Dyes, New Molecular
Materials – Putting Color in Nanotechnology

T.Torres



3.9. Honors

21.03.2013

Associated Editor of "Frontiers in Chemistry"

Link: www.frontiersin.org/Theoretical_and_Computational_Chemistry/editorialboard

J. Gierschner

04.04.2013

Young researcher award ELY LILLY SPAIN.

The Lilly research award is issued annually to an outstanding Spanish Chemist under the age of 40. Link: https://www.lilly.es/PRENSA/corporate-news/lilly-reconoce-con-el-premio-jovenes-investigadores-el-trabajo-del-doctor-juan-luis-delgado/@@new_page

J. L. Delgado

25.04.2013

Member of the Editorial Advisory Board of "Nanospectroscopy" (de Gruyter)

Link: <http://www.degruyter.com/view/j/nansp>

J. Gierschner

09-12.06.2013

Premio Nacional de la Sociedad Española de Virología.

Link: <http://www.cbm.uam.es/sev/16-2/Libro-Bu13.pdf>

J.L.Carrascosa

07-12.07.2013

Award "Conferencia EuCheMS". ESOC Marseille, France

Link: <http://www.esoc2013.eu/>

N. Martin

10.07.2013

Sigma Aldrich Emerging Investigators award. The Sigma Aldrich Awards are presented for outstanding work by researchers (members of the Royal Society of Chemistry of Spain, RSEQ) under the age of 40.

Link: http://www.madrid.org/cs/Satellite?c=CM_Actualidad_FA&cid=1354233846969&language=es&pagename=ComunidadMadrid%2FEstructura

J. L. Delgado

15.09.2013

Research Award and Gold Medal of the Royal Society of Chemistry of Spain.

Link: http://www.chemistryviews.org/details/ezone/5231471/Highest_Honor_of_the_Spanish_Royal_Society_of_Chemistry.html

T. Torres



15.09.2013

Best Poster Awards

XXXIV Reunión Bienal de la Real Sociedad Española de Química (RSEQ)

Award Richard E. Smalley. División de Nanocarbons de la Electrochemical Society

Link: <http://www.rseq.org/anales/numeros-atrasados/item/303-vol-109-n%C2%BA-3-julio-octubre-2013>

A. Latorre

15.11.2013

Dr. Begoña Sot, awarded with the L'Oreal – UNESCO "For Women in Science" programme



3.10. Scientific Outreach Activities

3.10.1. Talks

30.01.2013

I.E.S. Angel Corrella – Colmenar Viejo

La Revolución de los Superconductores

T. Gonzalez

<http://www.youtube.com/watch?v=CV1oaOIrl-8&feature=youtu.be>

05.02.2013

Porphylant Kickoff Meeting, Limoges, France

Optical Spectroscopy at IMDEA Nanoscience:
Overview & Perspectives

Johannes Gierschner

05.03.2013

CRIF Las Acacias, Madrid

Biomoléculas como elementos en nanociencia:
Ingeniería de proteínas / Biomolecules as elements in nanoscience: protein engineering
A.L. Cortajarena

21.03.2013

CSIC, Madrid, Comunidad de Madrid, España

Química y Nanociencia

N. Martin

17.04.2013

Universidad Rey Juan Carlos I, Madrid, Comunidad de Madrid, España

Nanotecnología y nanomateriales: una visión desde la Química

N. Martin

26.04.2013

Universidad de Valladolid, Spain

Nanopartículas magnéticas para aplicaciones en biomedicina (Ciclo de conferencias de la asignatura Perspectivas en Química)

G. Salas

07.05.2013

IMDEA-Nanociencia, Madrid, Comunidad de Madrid, España

All-organic Solar Cells. Fullerenes from UCM

N. Martin

08/05/2013

**I.E.S. “Jaime Ferrán” de Collado Villalba visits the-
IMDEA Nanociencia**

“Una artística experiencia: ¡Descubre la Nanociencia!”



Nº 11-Mayo-2013



Instituto IMDEA
Nanociencia

El pasado día 8 de mayo, en el marco de la Jornada de la Ciencia y la Tecnología, se celebró en la Ciudad Universitaria de Complutense la que vamos a presentar desde Villalba.

Así, una escuela de nanociencia en la que se podrá ver:

1. Una exposición de nanociencia y nanotecnología.

2. Una charla de nanociencia.

3. Una charla de nanociencia.

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45. Una charla de nanociencia.

scientific outreach activities

08.05.2013

IMDEA Nanociencia (High School Visits: IES Jaime Ferrán, Collado Villalba)

DNA & Nanoscience

Álvaro Somoza & Alfonso Latorre

23.05.2013

Facultad de Química, UCLM, Ciudad Real, Castilla-La Mancha, España

Química Supramolecular de nanoestructuras de carbono

N. Martin

22.05.2013

Real Academia de Ciencias Exactas, Físicas y Naturales, Madrid, Spain

Attoquímica: filmando el movimiento de los electrones

F. Martín

http://www.rac.es/7/7_1_1.php?id=107&i=1

31.05.2013

4º Jornadas de Química CISQ, Logroño

Materiales alternativos al grafeno: Diseñando Polímeros Bidimensionales

F. Zamora

21.06.2013

Universidad de Alcalá de Henares, Alcalá de Henares Spain

La importancia de los nanomateriales y las nanoestructuras en el desarrollo de (bio)sensores.

E. Lorenzo

Nanociencia: la importancia de lo pequeño

N. Martin

Hacia polímeros bidimensionales con diseño

F. Zamora

24.06.2013

Visit to the school Federico Garcia Lorca, Alcobendas

Outreach event of the ESTABLIS network: Why research on renewable energy?

Larry Lueer

24.06.2013

Universidad de Granada, Granada, Spain

Polímeros bidimensionales de diseño

F. Zamora

03.07.2013

Universidad Complutense de Madrid, Madrid, Comunidad de Madrid, España

Nanociencia: la importancia de lo pequeño

N. Martin

24.07.2013

Universidad de Alicante, Alicante Spain

Retos y oportunidades de la Química en Nanotecnología

N. Martin

27/09/ 2013

La Noche de los Investigadores - 27 de septiembre de 2013. La Ciencia del Salón de tu Casa



11.10.2013

Centro Andaluz de Biotecnología y Nanomedicina, Bionand. Málaga (Spain)

Single-molecule Biophysics: walk the line

J. Ricardo Arias-Gonzalez

23.10.2013

Universidad Autónoma de Madrid, Madrid, Spain
Nanopartículas y Oligonucleótidos en Nanomedicina

Álvaro Somoza

11.11.2013

Instituto de Ciencia de Materiales de Aragón
Zaragoza, Spain

Single-molecule Biophysics: walk the line

J. Ricardo Arias-Gonzalez

14.11.2013

IES Catalonia de Lancaster, Sta Mª Real de Nieva,
Spain

Nanotecnología contra el cáncer

Francisco Terán

8 & 15/11/2013

XIII Semana de la Ciencia<http://www.madrimasd.org/semanaciencia/>

13.12.2013

XIII Jornada Científica del Instituto de Ciencia
Molecular, Burjasot-Paterna, Valencia, Spain.

Subftalocianinas: Singulares moléculas aromáticas

Tomás Torres

19.12.2013

IMDEA Nanociencia (High School Visit, IES Gar-
cilaso de la Vega, Villacañas), Toledo, Spain

DNA & Nanoscience

Álvaro Somoza

XIII Semana de la ciencia



investigación, participación
y progreso

MADRID 2013 · 4 AL 17 NOVIEMBRE



INVESTIGACIÓN Y CIENCIA

BIOMOLÉCULAS Y NANOCIENCIA

FECHA v8 y v15 de 10:00 a 14:00

Una charla sobre el ADN, visita a los laboratorios, y experimentos de aislamiento de ADN y sobre el cambio de color las partículas de oro.

LUGAR Instituto IMDEA Nanociencia, C/ Faraday, 9, Ciudad Universitaria de Cantoblanco, Acceso movilidad reducida LOCALIDAD Madrid RESERVAS E-mail: patricia.lopez@imdea.org

ORGANIZAN Instituto IMDEA Nanociencia (Instituto Madrileño de Estudios Avanzados de Nanociencia) - Universidad Autónoma de Madrid

3.10.2. Media

22.01.2013

Media: El País

Title: Hacia las tecnologías de la información... genética

Link: http://sociedad.elpais.com/sociedad/2013/01/21/actualidad/1358801814_059030.html

J. Ricardo Arias-Gonzalez and E. Herrero-Galán

19.02.2013

Media: El País

Title: Tras los pasos físicos de la evolución del almacenamiento de información genética

Link: <http://www.madrimasd.org/informacionIdi/analisis/analisis/analisis.asp?id=55847>

E. Herrero-Galán and J. Ricardo Arias-Gonzalez

15.04.2013

Media: El País

Title: Ciencia y Capital

Link: http://sociedad.elpais.com/sociedad/2013/04/22/actualidad/1366646327_898780.html

J. Ricardo Arias-Gonzalez

29.05.2013

Media: Onda Madrid

link: Aquí no hay playa <http://www.nanociencia.imdea.org/noticias/2013/entrevista-al-prof-rodolfo-miranda-onda-madrid>

Rodolfo Miranda

09.07.2013

Media: W3 Radiostation

Title: "El Nanoscopio"

Link: <http://nanoscopio.radio3w.com/>

Begoña Milian

17/07/2013

IMDEA Nanociencia on the TV



16.10.2013

Media: El País

Title: Experimentos en Superordenadores F. Martín

Link: http://sociedad.elpais.com/sociedad/2013/10/15/actualidad/1381861303_352105.html

F. Martín

30.10.2013

Media: madri+d

Title: La EPO aprueba la primera patente europea de IMDEA Nanociencia

Link: http://www.madrid.org/cs/Satellite?c=CM_Actualidad_FA&cid=1354278028141&language=es&pagename=ComunidadMadrid%2FEstructura

Álvaro Somoza

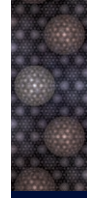
13.12.2013

Media: El Mundo

Title: La revolución nanotecnológica: una reinención del hombre

Link: <http://www.elmundo.es/ciencia/2013/12/13/52a98bda61fd3dfd478b456e.html>

J. Ricardo Arias-Gonzalez



26.12.2013

Media: "El Pais"

Title: ¿Para qué necesitamos la ciencia?

Link: <http://pendientedemigracion.ucm.es/info/fullerene/pdfs/El%20pais%2026-12-2013.pdf>

N. Martín

27.12.2013

Media: Revista Española de Física

Title: Premio Nobel a la Química Teórica en superordenadores

Link: <http://revistadefisica.es/index.php/ref/article/view/1917>

F. Martín, R. A. Matute

28.12.2013

Media: "Youtube"

Title: Bi-phobic RF paper fabricated by silanization reaction in the gas phase

<https://www.youtube.com/watch?v=roX6l82gB6o>

Ramses V. Martinez

28.12.2013

Media: "Youtube"

Title: Drop of blood rolling over the surface of omniphobic RF paper without leaving any trace behind

<https://www.youtube.com/watch?v=BIWXDaPv85E>

Ramses V. Martinez

28.12.2013

Media: "Youtube"

Title: Generation of water droplets in oil (the water is the pink colorant aqueous solution; the oil is the blue colorant hexadecane solution). This is the first demonstration of droplet generation using a microfluidic device made of paper. The channels were engraved in the paper before we silanized the paper to render its surface omniphobic

<https://www.youtube.com/watch?v=5s-pFSWCSRo>

Ramses V. Martinez

28.12.2013

Media: "Youtube"

Title: Paper SLIP fabricated with using omniphobic RF paper. The paper SLIPs repels blood, toluene, diethyl ether, oil, and water with low hysteresis. The paper SLIPs in this video are tilted only a 5-degree angle

<https://www.youtube.com/watch?v=REteOaLq9CU>

Ramses V. Martinez

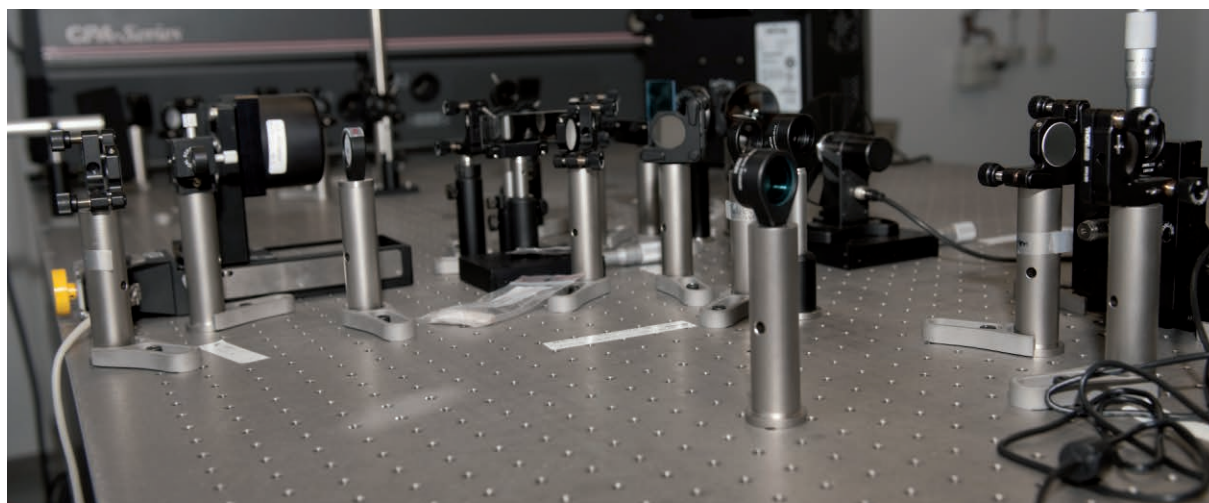
28.12.2013

Media: "Youtube"

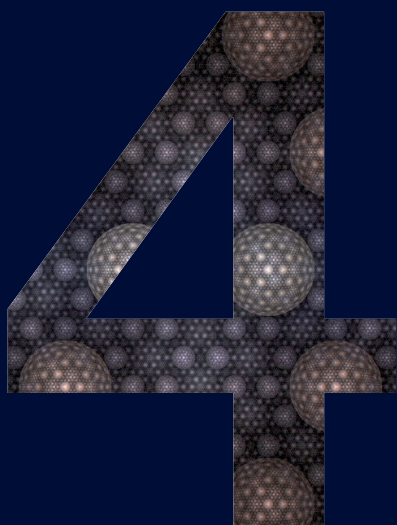
Title: Origami SLIP device fabricated using omniphobic RF paper. The green liquid is hexadecane with green colorant and the red one in dyed water. Both liquids can be driven through the paper SLIP without leaving any trace behind only by tilting the device 5 degrees

<https://www.youtube.com/watch?v=YK0utMSgHQo>

Ramses V. Martinez



research focus



4.1. Centre for Nanofabrication [114]

4.2. Nanomedicine Cooperation with HM Hospitals [118]

annual report
2013

the centre of n

contact info

daniel.granados@imdea.org

The Centre of Nanofabrication

The Centre of Nanofabrication is a joint proposal between the IMDEA-Nanoscience and campus of excellence UAM-CSIC to create a facility of excellence for the fabrication of nanostructures and devices based on a wide range of nanosciences such as 2D materials, nano-optics, photonics, nano-magnetism, bio-chemistry, micro-fluidics, nems&mems, or nanostructured organic semiconductors; among others.

The fabrication of such nanostructures and devices is crucial for fundamental research, but also for the development of prospective nanotechnologies with commercial applications. The Centre for Nanofabrication plays a key role for the development of the strategic plan of IMDEA-Nanoscience as well as of the campus of excellence UAM-CSIC. The Centre of Nanofabrication is hosted in a latest generation clean room, with more than 200m² of clean room surface and more than 500m² in total, including the technical gray area. The whole clean room is installed in a continuous solid concrete vibration-isolation floor, and is fully independent of IMDEA-Nanoscience building, since it has its own foundations and services (acclimatisation units, electrical power lines, water drains, earthings, gas lines, gas exhaust lines, etc.). This clean room is equipped with all the necessary equipment and safety needs required to warranty the safety, quality and purity of its installations, such as evacuation, filtering and recirculation of air as well as temperature and humidity control. Also it is equipped with all the safety equipment for the manipulation and disposal of hazardous liquids and gases to ensure the safety of the users and environment.

The construction of the clean room has been recently completed at the premises of IMDEA-Nanoscience at the end of 2013.

The clean room is divided in two main areas. The smaller section is approximately 60m² and has a certified air quality of ISO-5 (Class-100). The temperature is kept constant

anofabrication

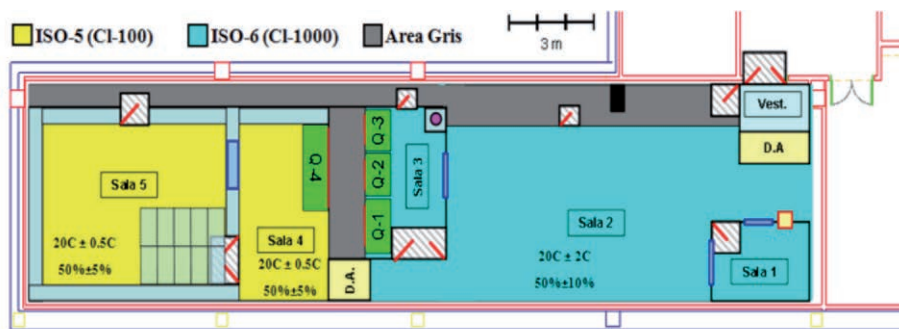


Comunidad de Madrid
www.madrid.org

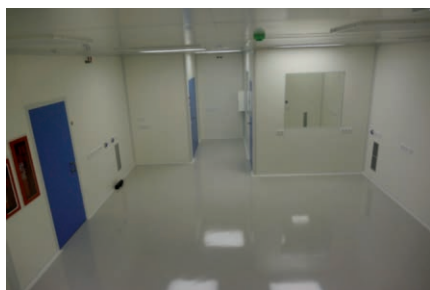


at $22 \pm 0.5^\circ\text{C}$ and the relative air humidity is kept constant at $50 \pm 1\%$. This section is devoted to lithography processes. Is equipped with electron beam Lithography (e-Beam), Focused Ion Beam Lithography (FIB), Gas Assisted Ion/Electron beam lithography (Multi-GIS), Mask-less Optical lithography and Nano-Imprint Lithography. This section is also equipped with a small wet chemistry room for all the processes related to nano and micro lithography, such as resist spinning, curing or developing. The largest section of the clean room is about 140m^2 and has a certified air quality of ISO-6 (Class-1000). In this section the temperature is kept constant at $22 \pm 2^\circ\text{C}$ and the relative air humidity is kept constant at $50 \pm 5\%$. This part is dedicated to sample and device fabrication. The clean room is equipped with several metal thin film evaporators, a unique Atomic Layer Deposition (ALD) reactor with 12 precursor lines and 800°C sample chuck, Inductively Coupled Plasma Reactive Ion etching (ICP-RIE) for deep cryo etching of Silicon compounds, Reactive Ion Etching for Metals and Insulators (RIE), Rapid thermal Processor (RTP), Stylus Profilometer (Dektak), Oxygen Plasma, Ozone Cleaner, Optical Microscopy, Wire Bonder, Diamond Scriber, Probe Satiation and Parameter analyser. This section is also equipped with an encapsulation room and a large wet chemistry room for all wet chemistry related processes like wet etching and cleaning, and comprises three laminar flow hoods one for solvents and bases, one for acids and one for HF. They are all fully equipped with drying spinner, ultra-sounds bath, reflow bath, DI water weir, mega-sounds bath, etc.

The Centre has been designed to provide service to all the scientists at IMDEA-Nanoscience as well as other users at the CEI UAM-CSIC and to a limited extent, elsewhere in Madrid and Spain. The latest available state of the art fabrication technologies will be on hand for the fabrication and manipulation of metallic, semiconducting and organic nanostructures and nanoscience-based devices. The centre of nanofabrication will provide the researches and users within the Cantoblanco campus of the UAM and in the framework of the Campus of Excellence project, with an efficient access to the necessary nanofabrication resources to be internationally competitive. Since IMDEA-Nanociencia is an institute created and financed jointly by the regional Government of Madrid and the Government of Spain, the Centre of nanofabrication is intentionally planned to be able to provide under demand services of nanofabrication to researchers of public institutions as well as to private companies.



Layout of the Centre of Nanofabrication clean room at IMDEA-Nanoscience.



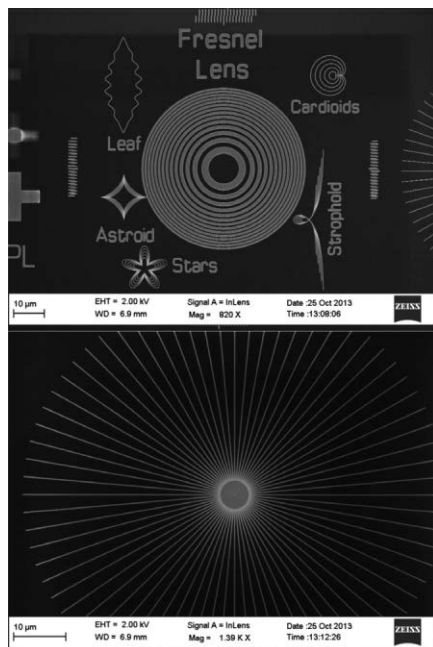
ISO-6 Section (Sala 2) of the Clean Room immediately after it was completed.



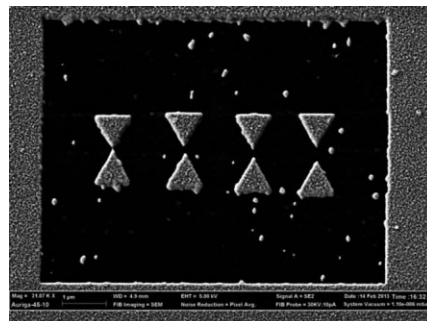
ISO-5 Section (Sala 5) of the Clean Room immediately after it was completed.



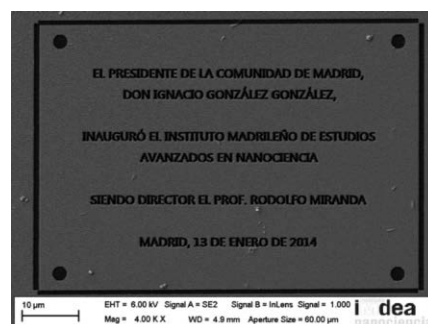
Wet chemistry laboratories at the ISO-6 section (left, Sala 3) and at the ISO-5 section (right, Sala 4).



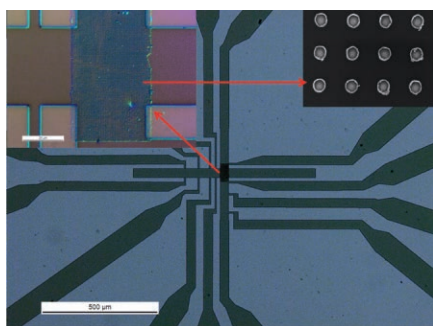
e-Beam Lithography test structures. Typical linewidth is 80nm for 100nm thick PMMA resist after a metal deposition and lift-off process with 20nm of Cr.



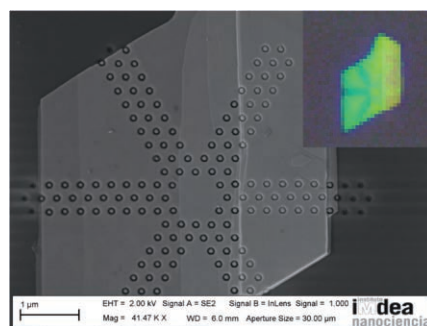
Bow-Tie optical nano-antennas fabricated by direct FIB milling lithography of 100nm of Au on Glass.



Inauguration "nano-placa" fabricated by direct FIB milling Lithography of 100nmAu on Si.



Combined e-Beam and mask-less optical lithography. An array of superconducting dots (top-right inset) with 100nm diameter was fabricated by e-Beam lithography in an area of 100 by 200 µm². A probing electrical bridge was fabricated on top of the dot array by mask-less optical lithography. The overlay accuracy is shown to be better than 200nm (top-left inset).



Array of semiconducting quantum dots fabricated on few layer MoS₂ by Gas assisted e-Beam milling Lithography. The top-right inset shows an optical image of the device.

nanomedicine

Nanomedicine cooperation with HM Hospitals

Nanomedicine is the medical application of nanotechnology and related research and covers areas such as nanoparticle drug delivery, nonmagnetic hyperthermia, improved imaging and possible future applications of molecular nanotechnology. It is a multi-disciplinary area involving physicians, physicist, chemist, biologists and biomedical engineers working together in the development of better diagnostic and therapeutic tools based on novel nanomaterials, advanced nanoelectronics and nanobiosensors. It also involves understanding and controlling issues related to biocompatibility, toxicity and environmental impact of nanoscale materials.

Many institutions doing scientific research in nanotechnology are somehow involved in the development on biomedical applications but there is still a great divide between research and practical clinical applications and most of the research efforts never end in practical medical improvements. IMDEA Nanoscience is committed to translational research and it is therefore establishing a network of key alliances with medical institutions to include their expertise at the early stages of research to ensure future transfer of the results from the lab to the hospital. One of these institutions is HM Hospitales, a network of private hospitals located in the Madrid Region.

HM Hospitals owns and operates six hospitals and currently employs about 4,000 health-care professionals. The flagship of this network the Comprehensive Cancer Center Clara Campal (CIOCC) located at HM University Hospital Sanchinarro one of the best Oncology Centers in Europe. CIOCC is a highly Specialized multidisciplinary center with well staff specialized units in the major cancer types. These units, led by senior physicians, carry patients on advance clinical and translational programs integrating new drugs, laboratory models, molecular pathology and imaging; having the unique qualifications needed for providing highly specialized integral care while offering world class treatments and technology.

CIOCC structure responds to a comprehensive analysis of the most effective, efficient and effective models that exist in the world of cancer treatment, which results in a multi-disciplinary approach in which patients are treated integrally in a single center without delay by the various specialists involved in their disease and possible complications. This model of providing care to cancer patients has its origins in translational research protocols and it is now applied with great success by HM Hospitals.

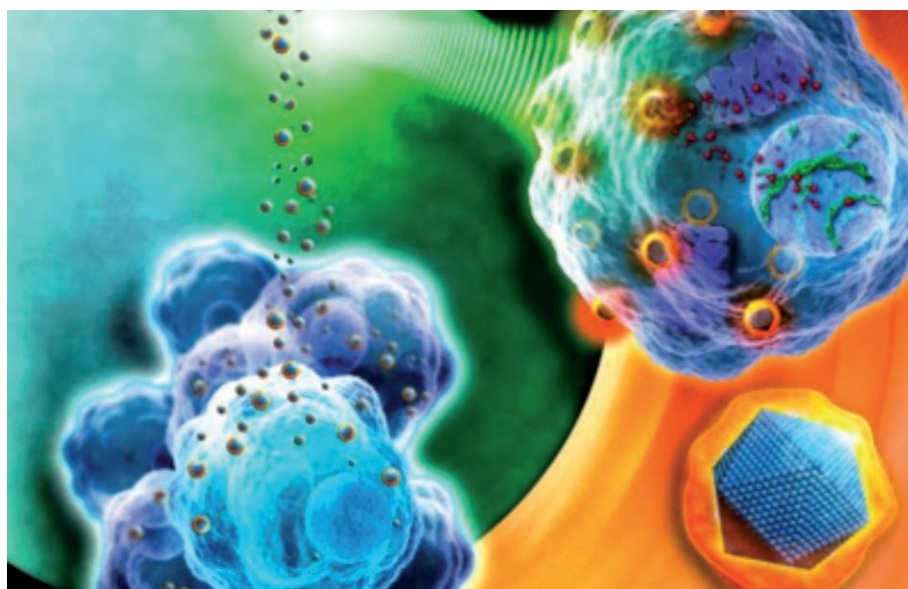
cooperation with HM Hospitals

IMDEA Nanoscience and HM Hospitals have joined their efforts to implement the first Nano-oncology Research Program in Spain involving nanoscientists and medical doctors and biologists in a common facility focused on implementing translational research projects and nanotechnology based medical applications mainly focused on cancer research. This program is being carried out at IMDEA's Nanomedicine Lab which is physically located at the IMDEA Nanoscience building and has been equipped with state of the art research instruments to carry out advance nanomedicine projects. The Nano-oncology Program is coordinated with the rest of infrastructures owned and operated by both IMDEA Nanoscience and HM Hospitals and is supervised by Prof. Rodolfo Miranda, Director of IMDEA Nanociencia and Dr. Cristóbal Belda, Director of Neuro Oncology at HM Hospitales. Currently more than 10 scientist and technician work at this lab on this program

Current Research projects and collaborations in the Joint Program

- Improved diagnostics and imaging of cerebral cancer through the use of superparamagnetic nanoparticles
- Evaluation of new hyperthermia therapies for the treatment of brain tumors with iron oxide nanoparticles
- Studies for the improvement of internalization of nanoparticles in brain malignant cells derived from surgical samples donated by patients
- Improvement of technics for labeling and follow-up of in vivo cells applied to regenerative medicine using nanotechnology

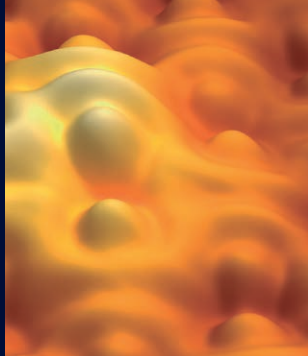
To implement the glioblastoma project IMDEA's Nanomedicine Lab runs in vitro and in vivo models including established human brain tumor cell lines (2D models), primary cultures of initiating glioblastoma cells derived from CIOCC – HM Hospitals patients (Malignant Stem Cells - 3D Models), surgically removed samples of tumoral and non tumor brain tissue and several in vivo models of mice cells.



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