

imdea nanoscience institute

nanoscience and nanotechnology: small is different

institute
imdea
nanoscience

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

2015

f o r e w o r d

foreword



Rodolfo Miranda

Director, IMDEA Nanociencia Institute
june 2016

annual report
2015

As you all know, these past years have been quite tough in many ways, and very painful and difficult for countries like Spain, where public support for Science has seen large cuts. It is therefore just to open this letter recognizing and praising the commitment of our Regional Government in supporting our center despite all odds, through all these problematic circumstances, and for giving us the certainty that this support will continue and even grow as soon as economic conditions allow it.

The past 2015 has been an important year for the consolidation and progress of IMDEA Nanociencia as a leading center for multidisciplinary advanced studies at the Nanoscale. New research programs have been created, important equipment has been finally set up and fresh brilliant and striving scientists have joined our teams. In summary, the Institute has continued moving upward in the highly competitive landscape of international Science.

Scientific production during 2015 has also reached higher level in terms of both quantity and quality. More than 170 articles have been published, many in some of the most prestigious journals. Likewise, the number of paper citations is over 3500, with a total accumulated of the order of 13220 citations and an institutional h-factor of 53. On the other, the patent funnel continues to get stronger, with 5 patents finally granted.

Fundamental research is thriving at IMDEA Nanociencia, as it was well recognized by the International Scientific Advisory Committee in their last report of progress and I am confident that the new evaluation that will be set up in June 2016 will definitively distinguish the significant scientific successes and infrastructure improvements made by IMDEA.

As you all recognize, research is mainly driven by the human innate desire to explore the unknown, and in our case as scientists it is focused on attaining improved understanding or prediction of natural phenomena. Though often driven by curiosity, basic research fuels applied science's innovation so research and development must always be coordinated and one of my main roles as Director of IMDEA Nanociencia is to make sure our center strikes the right balance between fundamental and applied research, which mainly driven by the strategic needs of society.

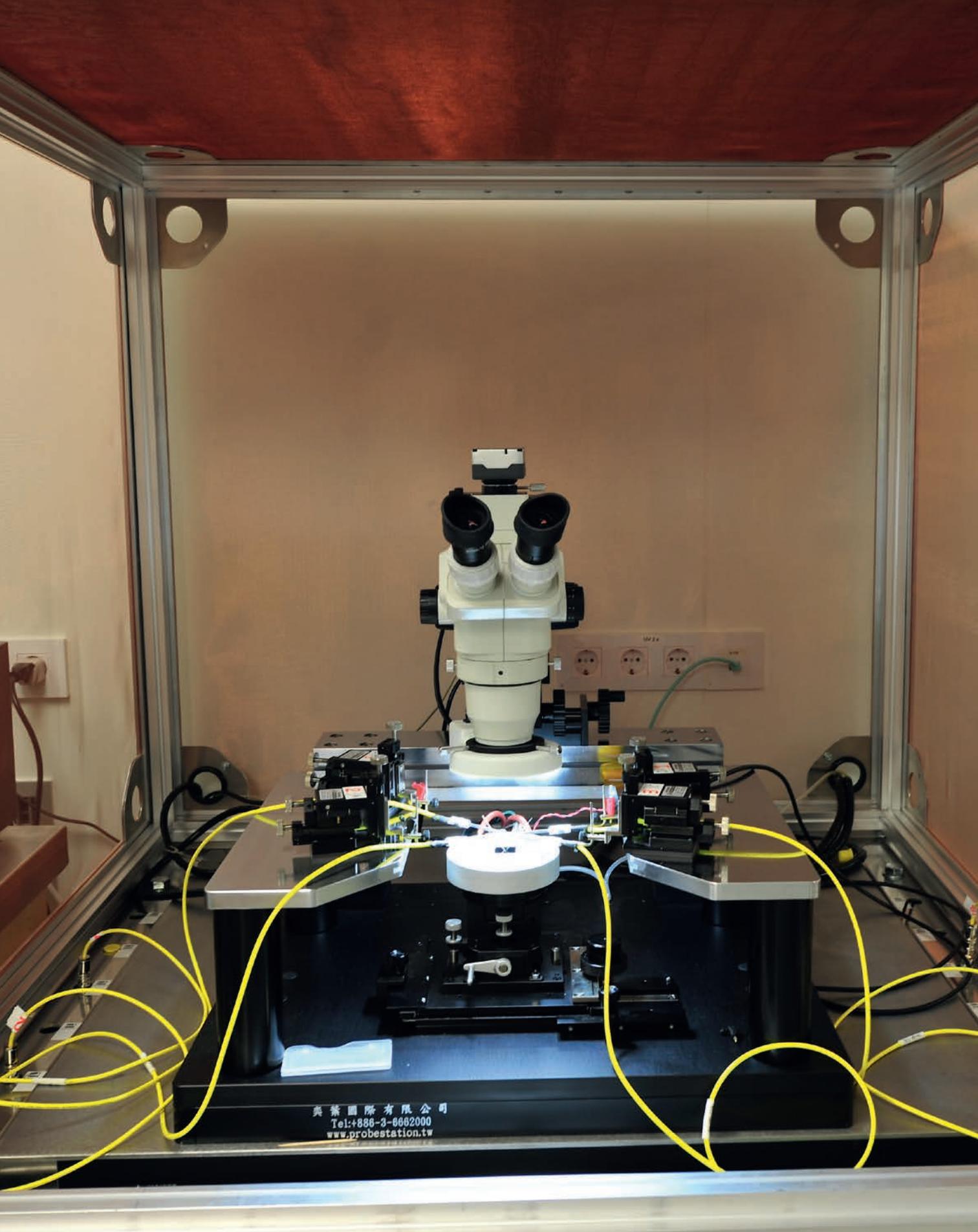
In 2015 we have continued consolidating our model of interdependent relations with innovative industries, which as you know is based on identifying medium-term strategic needs and foresighted challenges faced by society in general and by providers of public services and companies, so we can include these in our research programs as early as possible. A clear

foreword

illustration of this model is how, thanks to the close collaboration with Repsol during the SONAR road mapping teamwork during 2014, we have started in 2015 two lines of breakthrough research with REPSOL's Technology Center which aim very hot topics such as NOx contamination by diesel cars or ensuring more energy efficient ways for oil transport through pipes. Our collaboration with REPSOL through the SONAR Collaborative Project allowed us to identify technological challenges that contain enough basic science to stimulate our scientists and, at the same time, enough practical relevance to be of real interest for companies and has proven not only successful in itself, but quite fruitful for the institute.

After these first years of birth and rapid growth the forthcoming years will be crucial for consolidating the Institute and expanding its solid foundations. A key aspect for next year will be the consolidation of the management reorganization started by the end of 2015, which urgently needs more resources to be able to cope with the strenuous work load that it is currently supporting. Also, the internal government structure has been reinforced with the creation in December of an Executive Commission.

Let me finish by recognizing the passionate commitment put by researchers, technicians, managers and the rest of the personnel who make day by day commendable work for making our center an awesome reality and for ensuring a bright future for IMDEA Nanociencia.



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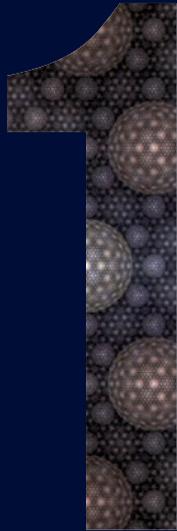
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c o n t e n t s

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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, Autónoma and Politécnica Universities, Consejo Superior de Investigaciones Científicas), 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.

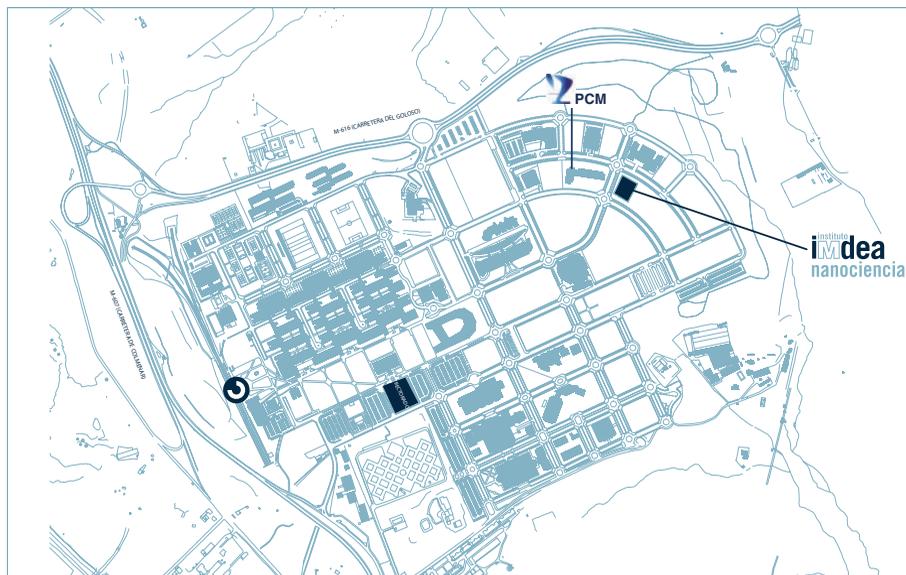
All this must be done by coordinating efforts with the groups and institutions that already exist, thanks to a flexible structure based on research programs, which will have to undergo periodic evaluations. IMDEA-Nanociencia aims at becoming an internationally recognized research center, while maintaining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

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.



IMDEA Nanociencia. Universidad Autónoma de Madrid. Cantoblanco Campus.



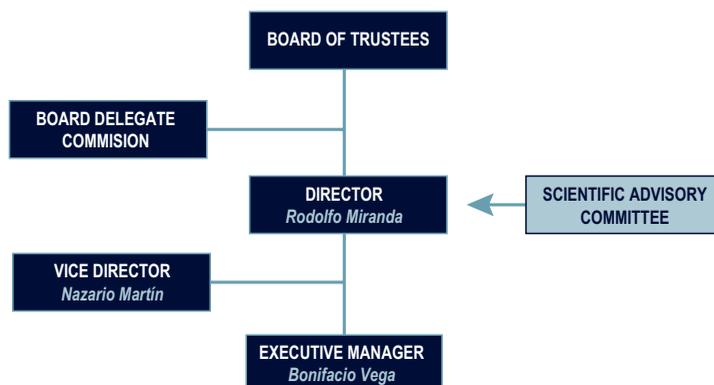


Researchers from different universities, the CSIC or other public institutions may also apply to the same selection procedure and be incorporated to the Institute as associated members for periods of five years to develop specific research projects. The corresponding agreements with different academic institutions have been signed.

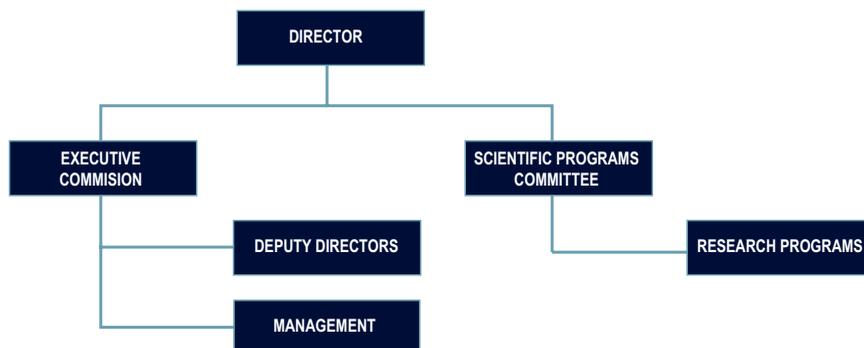
As a result of the recruitment procedure, more than 100 scientists work at IMDEA Nanociencia, 18 of which are associate scientists, and 48 are paid by various competitive programs. Currently, 30% of the scientific staff is foreign (9 different countries), and 88% have previously worked in foreign institutions.

1.5. Management Structure

Legally Binding Governing Structure



Internal Governing Structure



Research Programs Committee



Prof. Rodolfo Miranda



Prof. J. Camarero



Prof. J.L. Carrascosa



Prof. J.L. Vicent



Prof. J. Gierschner



Prof. I. Rodríguez



Prof. D. Granados



Prof. N. Martín



Prof. A. Bollero



Prof. C. Flors



Prof. E. Pérez



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

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University of Texas at El Paso, USA

Prof. Emilio Méndez

*(until April 2015)
Director of the Center for Functional Nanomaterials (CFN) Brookhaven National Laboratory Upton, NY. USA*

Prof. Héctor Abruña

Cornell University. USA

Prof. Cayetano López

*(since April 2015)
Director of CIEMAT, Spain*

Prof. Miquel Salmerón

*(since December 2015)
University of California, Berkeley, USA*

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Mr. Jerry B. Torrance

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

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GMV Aerospace and Defense

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Mr. Antonio Martínez García

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Mr. Fernando Temprano

1.7. Scientific Advisory Committee

Chairman: Prof. Ivan Schuller

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

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Cornell University, USA.

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Prof. Harald Brune

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

Prof. Yvan Bruynserade

Laboratory of Solid-State Physics and Magnetism. Department of Physics and Astronomy, Katholieke Universiteit Leuven, Belgium

Prof. Luis Echegoyen

Chair of Chemistry, University of Texas at El Paso, USA

Prof. Christoph Gerber

Director of Scientific Communication, NCCR Nanoscale Science, University of Basel

Prof. Dirk M. Guldi

Department of Chemistry and Pharmacy Interdisciplinary Center for Molecular Materials (ICMM) Friedrich-Alexander-Universitaet Erlangen-Nuernberg

Prof. René A. J. Janssen

Eindhoven University of Technology Molecular Materials and Nanosystems, The Netherlands

Prof. Dr. Jürgen Kirschner

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

Prof. Cayetano López

Director of CIEMAT, Spain

Prof. Maurizio Prato

Dipartimento di Science Farmaceutiche. Università di Trieste, Italy

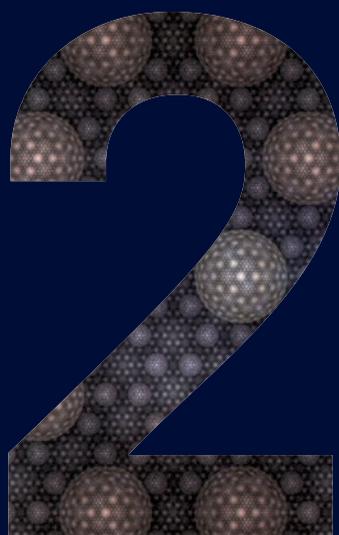
Prof. Rasmita Raval

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

Prof. Miquel Salmerón

University of California, Berkeley, USA

research
programmes
and scientists



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program

molecular nanoscience and chemical synthesis

Program Manager: Prof. Nazario Martín

Chemistry of Low-Dimensional Materials

Dr. Emilio M. Pérez

Nanocarbons and Organic Photovoltaics

Prof. Nazario Martín

Functional Organic Materials

Prof. Tomás Torres

Hybrid Nanomaterials

Dr. Beatriz H. Juárez

Covalent Organic Frameworks

Prof. Félix Zamora

Electrochemical Biosensors

Prof. Encarnación Lorenzo

Switchable nanomaterials

Dr. José Sánchez-Costa

Biosensors

Prof. José Manuel Pingarrón



Nanocarbons and Organic Photovoltaics

Prof. Nazario Martín

Double Affiliation: Universidad Complutense de Madrid, Spain

ORCID: <http://orcid.org/0000-0002-5355-1477>

Researcher ID: B-4329-2008

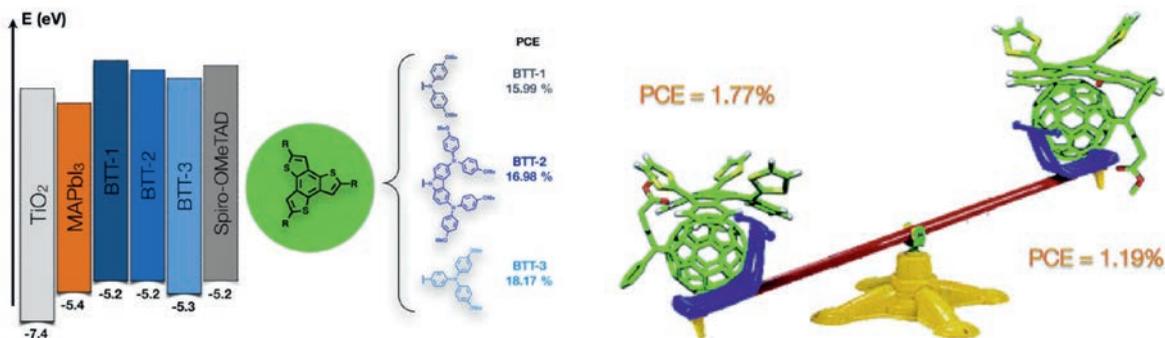
Group webpage: <http://www.nazariomartingroup.com/index.html>

Nazario Martín is full professor of Organic Chemistry at the University Complutense of Madrid and vice-director of IMDEA-Nanoscience. He has served as a member of the Editorial Board of *Chemical Communications*. He has been a member of the International Editorial Advisory Board of *The Journal of Materials Chemistry* (2000-2006) and a member of the Board of *The Journal of Organic Chemistry* and *Accounts of Chemical Research*, *ChemPlusChem*, *ChemSusChem* and *Chemistry-an Asian Journal*, and a member of the International Advisory Board of *Chemical Society Reviews* and *Chemical Communications*. Recently he became the Editor-in-Chief of *The Journal of Materials Chemistry* (A, B and C). 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 been appointed with the Spanish national "Jaime I Award for basic research" 2012, and the recipient of the "Alexander von Humboldt Award" and "Richard E. Smalley Research Award" (USA) in 2013. He has received the Catalán-Sabatier award from the French Chemical Society in 2014 and the prestigious "Miguel Catalán" award from the Madrid Community in 2015.

Research Lines

The research interests at the Prof. Martín's group span a range of targets mainly focused to the study of new materials for photovoltaic applications. In particular, our group is currently engaged in:

1. Design and synthesis of new hole transporting materials for high efficient perovskites solar cells. We have incorporated our new derivatives into photovoltaic devices based on perovskites displaying efficiencies as remarkable as 18.2 % (Chem. Commun 2015 and ACIE 2016).





Nanocarbons and Organic Photovoltaics

2. Electron transporting materials for perovskites solar cells. We have a very extensive experience in the preparation of new fullerenes derivatives. Taking advantage of this experience we want to use these new derivatives as electroactive materials for perovskites solar cells (*Adv. Funct. Mater.* 2005, *Adv. Funct. Mater.* 2010, *J. Mater. Chem.* 2011).
3. Device fabrication. We are also interested into devices preparation and characterization of both organic and hybrid devices.
4. Organic Photovoltaics. We are interested in designing new electroactive materials for bulk-heterojunction solar cells.



Inés García

Ph.D. student

Valentina Sacchetti

Ph.D. student (Università degli Studi dell'Aquila, Italy)

Rafael Sandoval

Ph.D. student

Dr. Agustín Molina

Postdoc
University of Texas at El Paso,
USA



Dr. José Santos

Postdoc
Durham University, UK



Chemistry of Low-Dimensional Materials

Dr. Emilio M. Pérez

Senior Researcher

Ph.D.: University of Edinburgh, UK

Previous Position: Universidad Complutense de Madrid, Spain

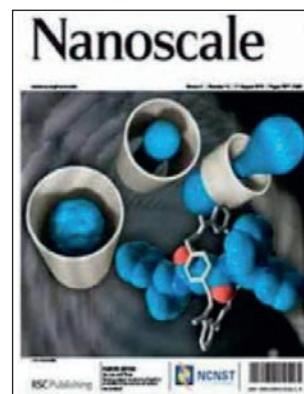
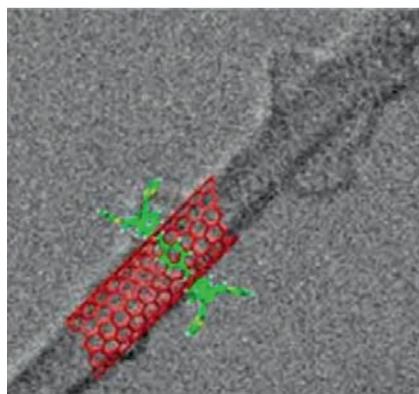
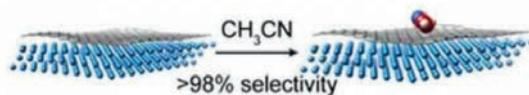
ORCID: <http://orcid.org/0000-0002-5355-1477>

Researcher ID: B-1870-2008

Group webpage: Chemistry of Low-Dimensional Materials

Emilio M. Pérez obtained his BSc (2000) and MSc (2001) in Chemistry from the Universidad de Salamanca. He then joined the group of Prof. David A. Leigh at the University of Edinburgh (UK) where he obtained his PhD in 2005. He joined the group of Prof. Nazario Martín at the Universidad Complutense de Madrid as a Juan de la Cierva postdoctoral fellow in 2005. In December 2008 he joined IMDEA Nanoscience as a Ramón y Cajal researcher. In 2013 he was promoted to Senior Researcher, and since December 2015 he is also Executive Director for Scientific Outreach. EMP has received several awards, including: the 2006 IUPAC Prize for Young Chemists, the 2009 RSEQ-Sigma-Aldrich Award for Novel Researchers, and the 2013 Miguel Catalán Award for Scientists <40 y.o.

The group has varied interests in the chemistry of low dimensional materials. In particular we are active in: 1) Chemistry of carbon nanotubes: We have introduced the mechanical bond as new tool for the chemical modification of single-walled carbon nanotubes (ACIE 2014, ChemComm 2015, Nanoscale 2016...). 2) Supramolecular chemistry: We are very interested in fundamental questions such as the nature of noncovalent interactions. We have developed a method for the determination of association



Chemistry of Low-Dimensional Materials

constants towards SWNTs (ChemSci. 2015). We are also interested in the self-assembly of functional materials (ACIE 2014). 3) Chemistry of 2D materials: We are interested in the liquid phase exfoliation and the chemical functionalization of 2D materials, such as graphene and transition metal dichalcogenides (NanoLett. 2016, Int. J. Mol. Sci. 2015).



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 Strasbourg, France



Functional Organic Materials

Prof. Tomás Torres

Associated Senior Scientist

Ph.D.: Universidad Autónoma de Madrid, Spain

Double Affiliation: Universidad Autónoma de Madrid, Spain

Group webpage: Functional Organic Materials

Tomás Torres is Full Professor of Organic Chemistry at UAM, and since January 2011 Associate Senior Scientist at IMDEA-Nanoscience. Ph.D. in Chemistry (1978) from UAM, he carried out postdoctoral stays at the Max-Planck Institute for Biochemistry in Munich (1978-1980) and at the Institute of Organic Chemistry, CSIC, Madrid, (1980-1981). Then, he worked at Abelló, SA/ Merck, Sharp and Dohme (1981-1985) in Madrid. In 1985 he obtained a position as Associate Professor at UAM. In 2000 he became Full Professor.

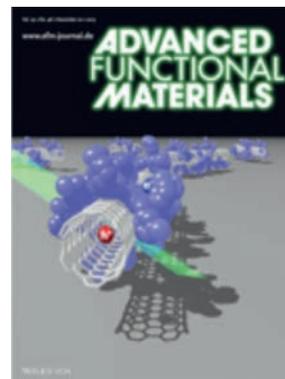
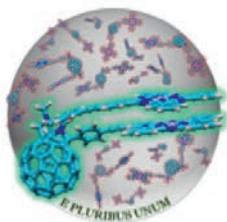
He leads a research group of 30 people, and has published over 470 articles and reviews and 41 patents (27 licensed), and has supervised 40 dissertations. He has an H index of 71. **Awards:** JANSSEN CILAG prize for Organic Chemistry (2005), Research Prize and the Gold Medal of the Spanish Royal Society of Chemistry (2013) and the Linstead Career Award in Phthalocyanine Chemistry by the Society of Porphyrins and Phthalocyanines (2016). **Distinctions:** Doctor Honoris Causa by the Ivanovo State University of Chemistry and Technology (ISUCT) Russia, 2009, Fellow of the Royal Society of Chemistry (FRSC) (UK) in 2014, and Doctor Honoris Causa by the Universidad Miguel Hernández of Elche in 2016.

Research Lines

- The group has been working in synthetic organic chemistry in areas ranging from pharmaceutical chemistry to the development of new organic materials and the study of their optical properties for applications in optoelectronics and organic solar cells, and more recently he has focused on areas of Nanoscience and Nanotechnology.
- The group has been funded with 10 EU projects and 12 more by other international and national agencies in the field of stable and low-cost organic solar cell technologies. In this connection, the group has made extraordinary advances in the preparation of photosensitizers for robust dye sensitized solar cells, like the phthalocyanine named TT1, which has become an obliged reference in the field, and the development of subphthalocyanine n-type materials as alternative to C60 derivatives as acceptors in organic solar cells. The group is opening his research interest also to the Nanomedicine area. Thus, the EU has funded a major project entitled (CosmoPHOS), in which the group is playing a crucial role in the preparation of photosensitizers linked to nanoparticles.

Recent Literature

- *Chem Rev.* **2014**, *114*, 2192. *Adv. Energy Mater.* **2014**, *4*, 1301413. *J. Am. Chem. Soc.* **2015**, *137*, 12914. *Angew. Chem. Int. Ed.* **2015**, *54*, 2543. *Angew. Chem. Int. Ed.*, **2015**, *54*, 7688. *J. Am. Chem. Soc.* **2015**, *137*, 8991. *Nano Lett.* **2015**, *15*, 1245. *ACS Nano* **2016**, *10*, 1565. *Angew. Chem. Int. Ed.*, **2016**, *55*, doi: 10.1002/anie.201601258.





Electrochemical Biosensors

Prof. María Encarnación Lorenzo

Associated Senior Scientist

Ph.D.: Universidad Autónoma de Madrid, Spain

Double Affiliation: Universidad Autónoma de Madrid, Spain

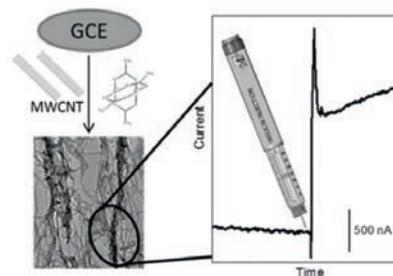
Researcher ID: K-9825-2014

Group webpage: [Electrochemical Biosensors](#)

María Encarnación Lorenzo Abad is currently Full Professor in the Department of Analytical Chemistry at the Universidad Autónoma de Madrid. She received her degree in Chemistry in 1978 and her PhD degree in 1985 from the Universidad Autónoma de Madrid. She made a post-doctoral stage at the Department of Chemistry at Dublin City University. In 1990 she was visiting scientist (NATO Program) to the Department of Chemistry in Cornell University. In 1998 she was invited by the members of the faculty of Tokio University of Agriculture and Technology as visiting professor in the Department of Applied Chemistry. She is the author/coauthor of more than 100 original research publications and several book chapters in the area of analytical chemistry and has received the award of Madri+d Foundation.

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, characterization and application of new electrocatalytic and optic materials for sensors and biosensors development.





Biosensors

Prof. José Manuel Pingarrón

Associated Senior Scientist

Ph.D.: Universidad Complutense de Madrid, Spain

Double Affiliation: Universidad Complutense de Madrid, Spain

Jose M. Pingarron obtained his Ph.D. (1981) from Complutense University of Madrid. Between 1982 and 1983, he did postdoctoral training at the Ecole Nationale Supérieure de Chimie de Paris. Since 1994, he is a full Professor of Analytical Chemistry at the Complutense University of Madrid. Jose M. Pingarron headed the Department of Analytical Chemistry at the Faculty of Chemistry between 1998 and 2006 and he was the President of the Spanish Society of Analytical Chemistry between 1998 and 2001. Professor Pingarron is the recipient of the Faculty of Chemistry Medal, the Complutense University of Madrid Medal and the 2012 research award on Analytical Chemistry of the Spanish Royal Society of Chemistry. He is author or co-author of 289 peer-reviewed papers, 23 book chapters and 2 text books as well as 6 invention patents. He is currently Vice-President of the Spanish Royal Society of Chemistry and is its representative in the Division of Analytical Chemistry of the European Association for Chemical and Molecular Sciences. Professor Pingarron is Associate Editor of Electroanalysis Journal and belongs (or belonged) to the Editorial Advisory Boards of the Journal of Electroanalytical Chemistry, Talanta, Analyst, Chemical Sensors and ChemElectroChem and Member of the Analytical Chemistry Division Committee of IUPAC. Moreover, Professor Pingarron is co-founder of the “spin-off” company Inbea Biosensores S.L.

Research lines

- His research interests focus on analytical electrochemistry, nanostructured electrochemical interfaces, nanomaterials and electrochemical sensors and biosensors.



Covalent Organic Frameworks

Prof. Félix Zamora

Associated Senior Scientist

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Researcher ID: E-6265-2014

Group webpage: Covalent Organic Frameworks

Pablo Albacete

Ph.D. student

Carlos Gibaja

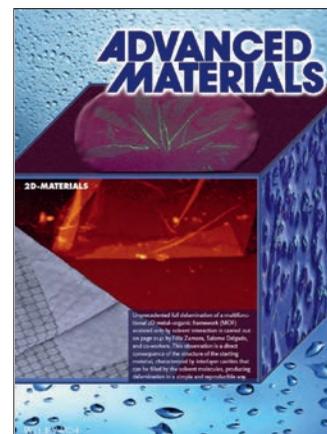
Ph.D. student

Felix Zamora is Professor at the Department of Inorganic Chemistry of the UAM and research associate of IMDEA Nanoscience. He obtained his BSc, MSc and PhD in Universidad Autónoma de Madrid (UAM). Then he got a Postdoctoral HTMR fellowship at the University of Dortmund (Germany) with Prof. B. Lippert. In 1997 he was visiting Prof. at the Chemistry Department in the University of Virginia and joined the Department of Inorganic Chemistry of the UAM. In 2003 he launched the “Nanomaterials” research group (www.nanomater.es). He has been recently awarded by the Spanish Royal Society of Chemistry with Research Excellence Award in 2015. His research activity has resulted in the publication of over 130 papers in scientific journals, three chapters in books, 8 patents. He has been visiting professor at the Nanoscience Laboratory (University of Newcastle), at the Chemistry Department of the National University of Singapore and at the Singapore Graphene Center. Since 2013 member of the editorial panel of Scientific Reports (Nature Publishing Group). He is founder and scientific advisor of the company Nanoinnova Technologies (spin-off of the UAM, www.nanoinnova.com).

Research Lines

The group has varied interests in the chemistry of low dimensional materials. The current research activity is focusing on the preparation and characterization of new nanomaterials with multifunctional properties:

- One-dimensional coordination polymers with electrical properties, and their potential use as “molecular wires”, and the use of coordination polymers of lamellar structure to produce nanometric films and monomolecular thickness [Nature Nano 5 (2010) 110-115; Nature Commun. 4, 1709 (2013); Chem. Soc. Rev. 2010, 39, 4220–4233].
- Two-dimensional materials with a rational chemical design using Covalent Organic Frameworks and Metal-Organic Frameworks: It aims to provide a range of two-dimensional graphene alternative polymers and the like [Adv. Matter. 25, 2141–2146 (2013); Chem Sci. 6, 2553–2558 (2015); Chem Commun 52, 4113-4127 (2016)].
- Two-dimensional materials based on inorganic crystals such as graphene, boron nitride and arsenene: Our aim is to provide novel synthetic routes for the production of suspensions and the characterization of these materials on surfaces [Chem. Sci. 6, 1949-1958 (2015);].
- Design and synthesis of porous materials with potential applications in water and energy based on Covalent Organic Frameworks [Chem. Eur. J. 21, 10666-10670, 2015].





Hybrid Nanomaterials

Dr. Beatriz H. Juárez

Associated Scientist

Ph.D.: Universidad Autónoma de Madrid, Spain

Double Affiliation: Universidad Autónoma de Madrid, Spain

ORCID: <http://orcid.org/0000-0003-1704-060X>

Researcher ID: G-7066-2011

Group webpage: Hybrid Nanomaterials

Beatriz H. Juárez is associated professor at the Universidad Autónoma de Madrid (from Sep 2012) and former researcher in the “Ramón y Cajal” programme at IMDEA Nanoscience (2008-2012). 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. The topic of her dissertation focused on Photonic Crystals and was supervised by Prof. C. López (<http://luxrurum.icmm.csic.es/>). Dr. H. Juárez 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 (https://www.chemie.uni-hamburg.de/pc/weller/index_e.html) with a Marie Curie Individual Intra European Fellowship. Dr. Juárez received in 2009 the junior nanotechnology prize given by AGENT-D.

Research lines

The nanoparticles laboratory (<http://www.nanoscience.imdea.org/nanoparticles-lab>) is mainly dedicated to the synthesis of colloidal semiconductor nanoparticles (quantum dots). The research lines include the synthesis of colloidal nanocrystal and hybrid systems, further processing, surface chemistry studies and optical characterization. In the last years, special focus has been given to hybrid systems composed of semiconductor nanoparticles and carbon sp^2 materials, such as carbon nanotubes and flat graphitic surfaces. In collaboration with J.R. Arias-González, optical trapping of quantum dots in also the focus of recent research. (<http://www.ariasgonzalez.com/onm---people.html>)

Relevant and representative publications of our research lines (since 2010) include:

- Protective ligand shells for luminescent SiO_2 coated alloyed semiconductor nanocrystals. M. Acebrón *et al.* *ACS Appl. Mater. Interfaces*, 2015, **7** (12), 6935–6945.
- Interfacing quantum dots and graphitic surfaces with Cl-based atomic ligands. F. Iacono *et al.*, *ACS Nano*, **7**, 3, 2559 (2013).
- Plasmon-exciton interactions on single photoresponsive platforms demonstrated by optical tweezers. S. Hormeño *et al.*, *Nano Letters*, **11**, 4742–4747, (2011).
- Ultrathin PbS Sheets by two dimensional oriented attachment. C. Schliehe *et al.*, *Science* **329**, 550 (2010).

Maria Acebrón

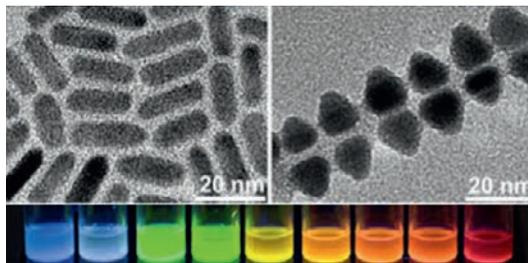
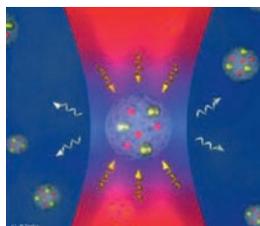
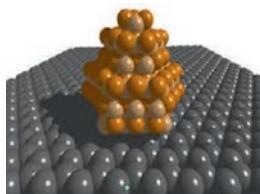
Ph.D. student

Héctor Rodríguez

Ph.D. student

Diego Ruiz

Technician





Synthesis and Study of Porphyrinoid-based Covalent and Supramolecular Ensembles

Dr. Giovanni Bottari

Associated Scientist

Ph.D.: University of Edinburgh, United Kingdom

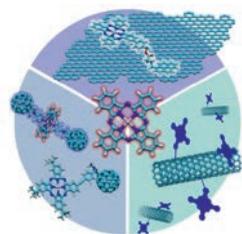
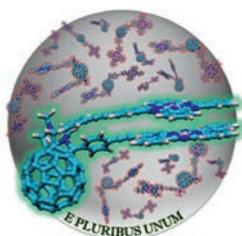
Double Affiliation: Universidad Autónoma de Madrid, Spain

Group webpage: <http://www.phthalocyanines.es/>

Giovanni Bottari obtained the bachelor's degree (1999) in Chemistry from the University of Messina (Italy). In 2000, he joined the group of Prof. David A. Leigh at the University of Edinburgh (UK) where he obtained his PhD in 2003. The same year, he joined the group of Prof. Tomás Torres at the Universidad Autónoma de Madrid (UAM) benefiting from a two-year Marie Curie Intra European Fellowship (2004) and a five-year Ramón y Cajal contract (2006). He is currently "Profesor Contratado Doctor" at UAM (2011) and associate scientist at IMDEA Nanociencia (2014). Recently, he has received the "John Shelnutz Young Investigator Award" from the "Society of Porphyrins and Phthalocyanines (SPP)" and the "Young Investigator Award" from the "Spanish Royal Society of Chemistry (RSEQ)", awards which recognize the outstanding contribution of young researchers in the field of porphyrinoids and general chemistry, respectively.

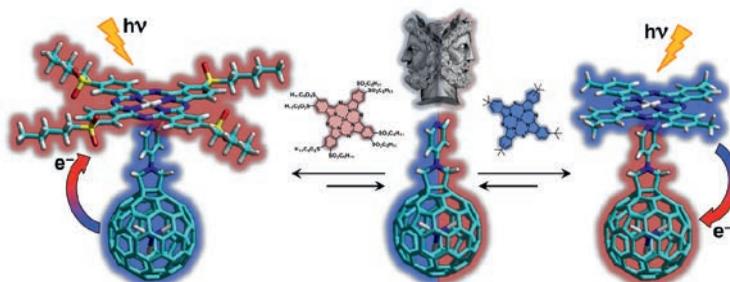
Research Lines

- Dr. Bottari's current research interests include, but are not limited to, i) the synthesis and study of donor-acceptor covalent and supramolecular ensembles based on porphyrinoids and electroactive moieties such as carbon nanostructures, tetracyanobutadiene, or cyclopenta[hi]aceanthrylene, among others, ii) the use of supramolecular interactions (hydrogen and halogen bonding, π -stacking, etc.) as a tool to promote the self-assembly of porphyrinoid derivatives both in solution and on surfaces, and iii) the preparation and study of fluorescent molecular rotors to be used as polarity and viscosity sensors both in organic and biologically-relevant media.



Recent Literature

- *Chem. Commun.*, **2014**, 50, 12955-12958, *Acc. Chem. Res.*, **2015**, 48, 900-910, *J. Am. Chem. Soc.*, **2015**, 137, 12914-12922, *J. Mat. Chem. C*, **2016**, 4, 3018-3027, *Angew. Chem. Int. Ed.*, **2016**, 55, 5560-5564; *Angew. Chem. Int. Ed.*, DOI: 10.1002/anie.201602713.





Nanosensors and nanomachines

Dr. Reynaldo Villalonga

Associated Scientist

Ph.D.: Havana University, Cuba

Double Affiliation: Universidad Complutense de Madrid, Spain

Reynaldo Villalonga obtained his PhD in Chemistry (2001) from Havana University (Cuba), working in the development of new approaches for the synthesis of neoglycoenzymes. He was full professor of Organic Chemistry and founding director of the Center for Enzyme Technology at the University of Matanzas, Cuba (2005-2009). He was visiting professor at Toyama Prefectural University (Japan), McGill University (Canada), Firenze University (Italy) and Joseph Fourier University of Grenoble (France). Currently he holds a Ramon y Cajal research contract at Complutense University of Madrid, and he is associate researcher at IMDEA-Nanosciences.

He was appointed as National Representative (2010-2011) and current fellow of IUPAC. He was awarded with the Development Cooperation Prize of Belgium in 2001. He is cofounder and scientific advisor of Orion High Technologies S.L., a company devoted to the design and commercialization of functional nanomaterials and nanohybrids, and nanomaterials-based biosensors. Dr. Villalonga has published over 120 research paper and chapter books.

Research lines

- Hybrid nanomaterials and nanostructured surfaces for biosensor design Enzyme-controlled nanomachines for drug delivery Anisotropic nanoparticles

program

time-resolved optical spectroscopy

Program Manager: Prof. Johannes Gierschner

Time-resolved Optical Spectroscopy

Dr. Johannes Gierschner

Pump-probe Photoinduced Absorption Spectroscopy

Dr. Juan Cabanillas-González

Femtosecond Spectroscopy on Molecular Systems

Dr. Larry Luer

Nanooptics and Nanoacoustics

Dr. Reinhold Wannemacher



Time-resolved Optical Spectroscopy

Dr. Johannes Gierschner

Senior Researcher

Ph.D.: University of Tübingen, Germany

Previous Position: University of Mons, Belgium

ORCID ID: 0000-0001-8177-7919

Researcher ID: K-7938-2014

LOOP profile: 85616

Scopus Author ID: 6603576997

Group webpage: [Time-resolved Optical Spectroscopy](#)

Johannes Gierschner received his PhD at the University of Tübingen, Germany in 2000. After postdoctoral stays in Tübingen, Mons, and GeorgiaTech, he joined IMDEA Nanoscience in 2008 as a Senior Researcher (Ramón y Cajal fellow 2008-13). In 2014, he finalized his habilitation at the University of Tübingen, and holds an adjunct professorship (Privatdozent) there since then.

His more than 90 peer-reviewed publications (3700 citations, h-index of 33) are dedicated to integrative spectroscopic/computational research on different classes of conjugated organic materials. J.G. has presented his work in more than 50 oral presentations at international conferences (19 invited) and 80 invited seminars at research institutes. He has coordinated 2 Marie-Curie RTNs and 2 national projects (currently: MultiCrom). He was holding a visiting researcher position at the University of Valencia (2008-11), adjunct professor positions at Seoul National University (SNU; 2014/15) and University of Mons (2014/15), and is regular visiting researcher at SNU since 2009. J.G. has 20 years' experience in teaching and supervision, and organized numerous symposia, schools, and research meetings. He is a peer reviewer for more than 40 ACS, Wiley-VCH, RSC, Elsevier, NPG, AIP and Springer journals, associate editor of 'Frontiers in Chemistry', board member for 'Nanospectroscopy' and of several conference series.

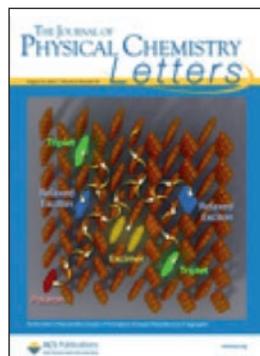
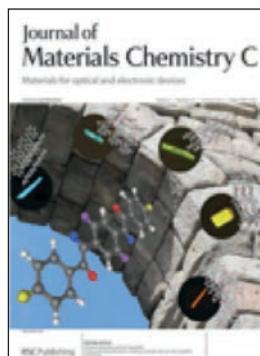
Research Lines

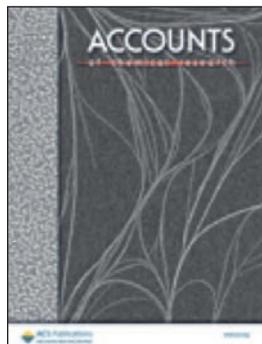
Our work follows an integrative spectroscopic/computational research on different classes of supramolecular conjugated organic materials, relying on long standing collaborations with materials scientists in-house and abroad:

1. One-/two component solid state fluorescent and phosphorescent materials.
2. All-organic non-fullerene organic solar cells.
3. Binary chromophore / carbon allotrope materials.
4. Addressable supramolecular host-guest compounds with cooperative optical response.
5. Conjugation in oligomeric and polymeric materials.
6. Color stabilization in natural compounds.
7. Multi-responsive fluorescent bi/tri-color switches based on molecular dyads/triads and mixed co-crystals.

Recent overviews:

- *Organic Single Crystal Lasers - a Materials View*, Adv. Opt. Mater. 4 (2016) 348.
- *Stabilizing and Modulating Color by Copigmentation: Insights from Theory and Experiment*, Chem. Rev. 116 (2016) in print.





- *Computational Engineering of Low Bandgap Copolymers*, Front. Chem. 1 (2013) 35.
- *Luminescent Distyrylbenzenes: Tailoring Molecular Structure and Crystalline Morphology*, J. Mater. Chem. C 1 (2013) 5818.
- *Highly Emissive H-Aggregates or Aggregation-Induced Emission Quenching? The Photophysics of All-Trans Para-Distyrylbenzene*, J. Phys. Chem. Lett. 4 (2013) 2686.
- *Directional Exciton Transport in Supramolecular Nanostructured Assemblies*, Phys. Chem. Chem. Phys. 14 (2012) 13146.
- *p-Conjugated Cyanostilbene Derivatives: A Unique Self-Assembly Motif for Molecular Nanostructures with Enhanced Emission and Transport*, Acc. Chem. Res. 45 (2012) 544.



Dr. Mike Wykes

Postdoc
Cambridge Display
Technology, UK



**Dr. Paramjyothi C.
Nandajan**

Postdoc
National Institute for
Interdisciplinary Science and
Technology (CSIR-NIIST)

Shi Junqing

PhD. student
(Beijing Normal University,
China)

Rim Milad

Visiting Ph.D. student
(Université de Carthage, La
Marsa, Tunisia)



**Dr. Santanu
Bhattacharyya**

Postdoc
Indian Association for the
Cultivation of Science, Kolkata,
India



Dr. Begoña Milian

Visiting Researcher
Universidad de Valencia, Spain



Femtosecond Spectroscopy on Molecular Systems

Dr. Larry Luer

Senior Researcher

Ph.D.: University of Tübingen, Germany

Previous Position: Politecnico di Milano, Italy

Researcher ID: L-9375-2014

Larry Luer received his diploma (1996) and PhD (2001) in Physical Chemistry from Tübingen University, working on oxygen effects on photoconductivity in small molecules. In 2001, he went to Politecnico di Milano on a Marie Curie Individual Fellowship to work with Guglielmo Lanzani and Giulio Cerullo in femtosecond spectroscopy studying ultrafast charge carrier generation. In 2002, he returned to University of Tübingen as a postdoctoral fellow to work on oxygen induced degradation of polymers in an industry driven project. In 2003 he started a tenure track position as senior researcher at CNR/INFM Politecnico di Milano, applying ultrabroadband pulses to study energy and charge transfer phenomena in the condensed phase, in the groups of Giulio Cerullo and Guglielmo Lanzani. In 2007, this position became permanent. In 2009, he started working at IMDEA Nanoscience as a senior researcher and Ramon y Cajal fellow. Since 2012 he is responsible for the femtosecond spectroscopy lab at IMDEA nanoscience, which is part of the Madrid network of user labs (Madri+D Redlab #280).

Larry Luer is member of several National and European research projects with strong industrial participation, and has coordinated two European Marie Curie training networks.

Research lines

We combine advanced methods for spectroscopy and data analysis in order to resolve and quantify the elementary photophysical pathways occurring in organic optoelectronic devices. We develop destruction-free methods that are material and layer sensitive thus allowing to trace back device performance to first principles. All of our work is done in intense collaboration with international leading industries and groups working in device technology, material science and biophysics.

1. **Stability and efficiency of organic solar cells (OSCs).** These devices are very promising for decentralized energy production close to the customer but suffer from limited efficiency and stability. Both problems are related to undesired loss processes in the complex photovoltaic event chain. Our techniques allow us to single out dominant loss processes caused by oxygen induced or thermal degradation, and to suggest improvement strategies to our industrial partners (projects ESTABLIS, POCAONTAS, FotoCarbon + in-house collaborations).
2. **Excitonic effects in condensed matter.** We combine matrix based data analysis methods with quantum chemistry to model two-dimensional electronic spectra of natural light harvesting complexes and other low-dimensional materials. This allows us to understand the details of the interactions of excitons with the environment. This knowledge can be used to design novel optoelectronic devices (collaborations with Politecnico di Milano, University of Glasgow, and in-house).

Safakath Karuthedath

Ph.D. student

(National Institute of Technology, Calicut, India)

Abasi Abudulimu

Ph.D. student

(Umea University, Sweden)

Diana Figueroa del Valle

Visiting Ph.D. student

(Fondazione Istituto Italiano Di Tecnologia, Milano, Italy)



Nanooptics and Nanoacoustics

Dr. Reinhold Wannemacher

Senior Researcher

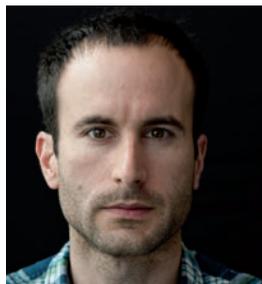
Ph.D: University of Darmstadt, Germany

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. Phasesensitive acoustic microscopy, imaging, and non-destructive testing.



Dr. Daniel Cano

Postdoc

Eberhard-Karls-Universität at
 Tübingen, Germany



Pump-probe Photoinduced Absorption Spectroscopy

Dr. Juan Cabanillas-González

Researcher

Ph.D.: Imperial College London, UK

Previous Position: Politecnico di Milano, Italy

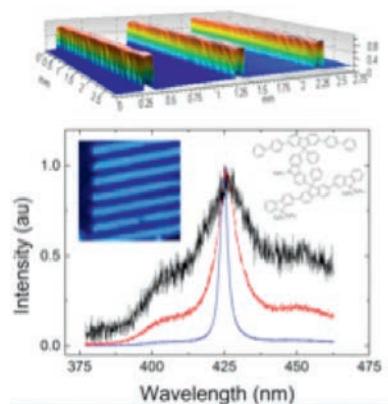
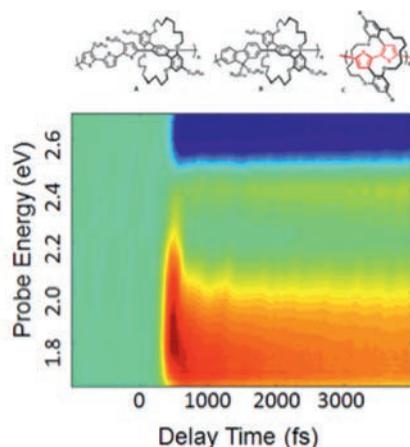
Researcher ID: M-1026-2014

Juan Cabanillas-González graduated in Physics at Universidade de Santiago de Compostela in 1999. He got a PhD in Physics from Imperial College London working with photophysics of conjugated polymers with Prof. Donal Bradley. In 2003 he started a post-doctoral stage at Politecnico di Milano with Prof. Guglielmo Lanzani. In 2009 he was appointed Ramon y Cajal fellow at IMDEA Nanociencia (Madrid). His main research interests concern with excited state dynamics in conjugated polymers and the application of these materials to different fields such as lighting, light detection and chemical sensing.

Research Lines

The group investigates the use of time-resolved spectroscopy (transient absorption and time-resolved photoluminescence) for the understanding and optimization of fundamental processes in organic-based devices. Additionally we fabricate and characterize devices such as polymer laser resonators, polymer waveguides or photodectors. Currently, our research is focused on these topics:

- 1. Photophysics of novel conjugated polymers with improved emission and light amplification properties.** Inter-chain interactions in solid state often lead to unwanted broad photoinduced absorption which overlaps spectrally with stimulated emission. We study the excited-state dynamics of polymers with chemical structures which promote optical gain upon reducing inter-chain interactions. Examples of these polymers are conjugated polyrotaxanes with cyclodextrin rings surrounding the backbone, polymers with bulky side-chain substituents or polymers with backbone encapsulated by cyclic side-chain substituents.



2. **Relation between nanostructure and emission properties in conjugated polymer blends.** Host: guest conjugated polymer mixtures coupled by Förster resonant energy transfer are suitable candidates as optical gain medium in laser cavities. Large miscibility of host and guest polymers is crucial for outstanding light amplifying performance. We investigate the relation between thermodynamical properties of the mixture, film morphology and absorption / emission properties. Our goal is to promote miscibility upon optimization of different parameters, (molecular weights, side-chain substitution, and solvent for film processing).
3. **Fabrication and characterization of polymer waveguides and laser resonators by soft nanoimprint lithography.** We use this technique to transfer patterns onto semiconducting polymer films or on substrates subsequently coated by conjugated polymer. Currently we develop and characterize distributed feedback laser resonators as well as rib waveguides based on novel polymers on flexible substrates. We investigate the use of laser emission in open cavities as transduction signal for sensing analytes in the gas or liquid phase.
4. **Organic-based position sensitive photodetectors.** Organic photodetectors based on small molecule multilayers with continuous lateral thickness gradients are developed. By depositing active layers with wedge geometry we exploit thickness-dependent effects such as optical interference or antibatic diode response to achieve spatially-dependent spectral response and linear photocurrent changes as the light impinges different positions on the active area.



Dr. José Raúl Castro Smirnov
 Postdoc
 Universidad de Sevilla, Spain

Longfei Wu

Ph. D. student
 (Beijing Normal University,
 China)

Qi Zhang

Visiting Ph.D. student
 Nanjing University of Posts and
 Telecommunications, China

Chen Sun

Ph. D. student
 (Beijing Normal University,
 China)

Giulin Liu

Visiting Ph.D. student
 (Jiangnan University, China)

program

scanning probe microscopies and surfaces

Program Manager: Prof. Rodolfo Miranda

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 under the supervision of 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 “Nicolas Cabrera”. He has served on Advisory Committees for different institutions, such as the Surface Science Division of IUVSTA, the Max Planck Institute für Mikrostruktur Physik or the European Synchrotron Radiation Facility (ESRF). Prof. Miranda is Fellow of the American Physical Society since 2007, Head of the Surface Science Lab of the UAM (LASUAM) and Director of the Madrid Institute for Advanced Studies in Nanoscience (IMDEA-Nanociencia) from February 2007.

Prof. Miranda’s research interests range from low dimensional magnetism or molecular self-organization on surfaces to the mechanisms of epitaxial growth, the growth and properties of graphene or the use of magnetic nanoparticles in nanomedicine. Together with his collaborators, has developed instruments to perform Scanning Tunnelling Microscopy (STM), Helium Atom Scattering (HAS) or Angular Resolved Photoemission (ARUPS) in Ultra High Vacuum conditions. Professor Miranda has authored and coauthored more than 270 scientific publications, which have received nearly 10.000 citations. He has supervised more than 40 PhDs and postdoctoral researchers.

miliKelvin STM

Prof. Amadeo L.
Vázquez de Parga

Nanoarchitectures at surfaces

Dr. David Écija

Spin-Polarized low T STM

Dr. Fabián Calleja

Surface Reactivity

Prof. Juan M. Rojo

Photonic STM

Dr. Roberto Otero

Modelling

Prof. Fernando Martín

Nanotribology

Dr. Rubén Álvarez Asencio

SNOM

Dr. Daniel Granados



Nanotribology

Dr. Enrico Gnecco

Senior Researcher

Ph.D.: University of Genoa, Italy

Previous Position: University of Basel, Switzerland

Enrico Gnecco received his PhD in Physics from the University of Genoa in 2001, and worked several years at the University of Basel before joining IMDEA Nanociencia in 2010. Among other topics, he investigated atomicscale 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 80 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 Szymonski, and edited the book “Fundamentals of Friction and Wear on the Nanoscale” (Springer, 2007 and 2014) with Ernst Meyer. Last but not least, he was awarded a diploma in piano from the Conservatory of Music of his hometown, Genoa.

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



Patricia Pedraz

Ph.D. student

Dr. Ruben Álvarez-Asencio

Postdoc

KTH, Sweden



Spin-Polarized low T STM

Dr. Fabián Calleja

Researcher

Ph.D.: Universidad Autónoma de Madrid, Spain

Previous Position: Ecole Polytechnique Federale de Lausanne (EPFL), Switzerland

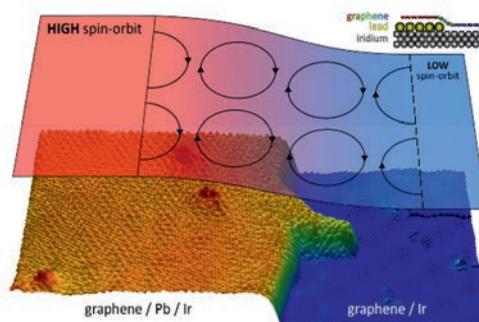
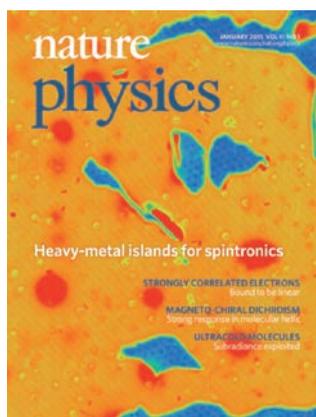
Researcher ID: I-7964-2012

Fabián Calleja obtained his BSc (2001) and MSc (2002) in Physics from the Universidad Autónoma de Madrid. He then joined the group of Prof. Rodolfo Miranda in the Surfaces Laboratory of the Universidad Autónoma de Madrid, where he obtained his PhD in 2007. Then he joined the group of Prof. Harald Brune in the Laboratory of Nanostructures at Surfaces of the Federal Polytechnical School of Lausanne (EPFL) as a post-doctoral researcher. In January 2011 he joined IMDEA Nanoscience, where he is currently hired as a researcher. At present FC works in two independent UHV STM systems: The LT-STM laboratory (standard 4K bath cryostat) and the JT-STM laboratory (Joule-Thompson 1K cryostat and 3T superconducting magnet).

Research Lines

- Our research career is devoted to the study of the electronic and magnetic properties of nanometric systems often based on graphene, ranging from isolated atoms or molecules to clusters of arbitrary size or networks. The main goal is to achieve a deep understanding of the interaction between the different nanostructures and graphene, and the corresponding modification of graphene's intrinsic properties, an important milestone in the potential development of graphene-based spintronic devices. Current research lines are based on metal-supported graphene systems, and can be split in two main groups: The adsorption of organic molecules on metal-supported graphene (Nature Physics 9, 368 - 374, 2013) and the intercalation of heavy metal atoms between graphene and the underlying metallic substrate (Nature Physics 11, 43 - 47, 2015).

Juan José Navarro
Ph.D. Student





Nanoarchitectures at surfaces

Dr. David Écija

Researcher

Ph.D.: Universidad Autónoma de Madrid, Spain

Previous Position: Technical University of Munich, Germany

Researcher ID: I-2207-2012

Group webpage: <http://ecija.hol.es>

David Écija received a PhD degree in Physics from UAM, with a work on self-assembly of nanostructures on surfaces. He was awarded a Marie Curie Intra European Fellowship and moved to Prof. Barth's group at the Technical University of Munich, where he carried out a four-year stay working on functional molecular nanoarchitectures on surfaces amenable to scanning probe microscopies. In January 2014 he joined IMDEA Nanoscience as Researcher and "Ramon y Cajal" fellow.

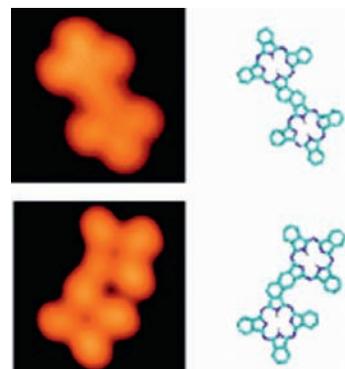
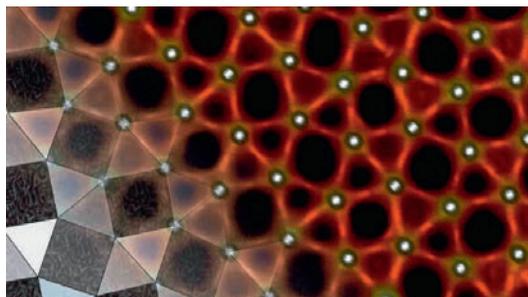
Research Lines

We are an enthusiastic team of scientists focused on the study of physical-chemistry and molecular nanoscience at interfaces. To this aim we combine state-of-the-art scanning probe microscopies, photoelectron and optical spectroscopies with density functional calculations. Our research lines include:

- Coordination chemistry at surfaces.
- Supramolecular self-assembly at solid surfaces.
- On-surface synthesis of functional materials.
- Molecular recognition at interfaces.
- Hybrid nano-materials.

Borja Cirera

Ph.D. student





miliKelvin STM

Prof. Amadeo L. Vázquez de Parga

Associated Senior Scientist

Ph.D.: Universidad Autónoma de Madrid, Spain

Double Affiliation: Universidad Autónoma de Madrid, Spain

Researcher ID: L-2418-2013

Amadeo L. Vázquez de Parga obtained his PhD in Physics 1992 at the Universidad Autónoma de Madrid (UAM). He carried out a postdoc stay at IBM Research Laboratory in Rüschlikon (Switzerland) working on the characterization of the light emitted by the tunneling junction in a Scanning Tunneling Microscope. 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. In 2002 and 2003 was a visiting researcher at the Radboud University, Nijmegen (The Netherlands), working on spin polarized STM. During his career he made short research stays at Lawrence Berkeley Laboratory, California in 1990, Max Planck Institute in Halle (Germany) in 2000, the Gakushuin University in Tokio (Japan) in 2004 and the Chiba University (Japan) in 2015.

Research Lines

- The group is working on the characterization by means of low temperature scanning tunneling microscopy and spectroscopy (LT-STM/STS) the surface of epitaxial 2D materials and topological insulators. In particular we have been working on the growth of graphene on different transition metals and the resulting crystallographic and electronic properties (Phys. Rev. Lett. 100, 056807 (2008), ACS Nano 7, 2927 (2013),). The properties of epitaxial graphene can be functionalized by different methods, like the intercalation of atoms between the graphene and the metallic substrate (Nature Physics 11, 43 (2015), Nano Letters 16, 2 (2016)), or the covalent bonding of chemical species (Nano Letters 16, 355 (2016)) or the absorption of electron acceptor molecules (Nature Physics 9, 368 (2013), Nano Letters 14, 4560 (2014)).



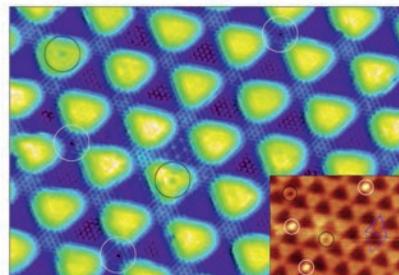
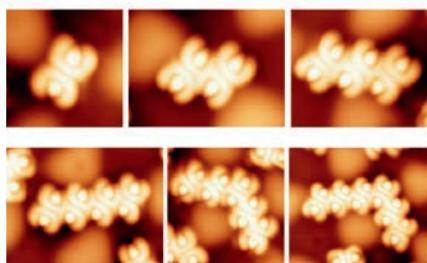
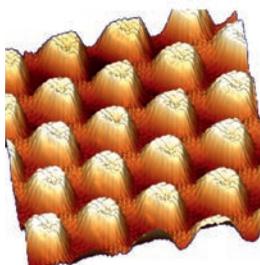
Dr. Andrew Norris

Researcher

Weizmann Institute, Israel.

Andrés Black

Ph.D. student





Modelling

Prof. Fernando Martín

Associated Senior Scientist

Ph.D.: Universidad Autónoma de Madrid, Spain

Double Affiliation: Universidad Autónoma de Madrid, Spain

Group webpage: <https://campusys.qui.uam.es/>

Fernando Martín graduated in Chemistry, specialty Quantum Chemistry, in 1984 and Physics, specialty Theoretical Physics, in 1986 at the Universidad Autónoma de Madrid. He received his PhD degree at the same university in 1986. Then, he completed postdoctoral studies at the University of Bordeaux I (1988), the Université de Paris VI (1989-1990) and the University of Chicago (1995-1996). He has been Associate Professor from 1993 to 2005 and since then Full Professor at the Universidad Autónoma de Madrid. He is member of IMDEA Nano since 2010.

He has published more than 370 articles, among them several in Science, Nature, etc. In 2000, he was awarded the National Research Prize Rey Juan Carlos I, in 2010, the prize of the Spanish Royal Society of Chemistry in Chemical Physics and in 2011, the Advanced Grant from the European Research Council XCHEM.

He has been PI of more than 20 grants. He has chaired several European networks, and has been the Spanish representative in the Atomic, Molecular and Optical Physics Division of the European Physical Society. He has supervised 16 doctoral and 14 master theses, and is currently Chair of the “Cátedra UAM-Fujitsu” on Scientific Computing and Big Data.

Research Lines

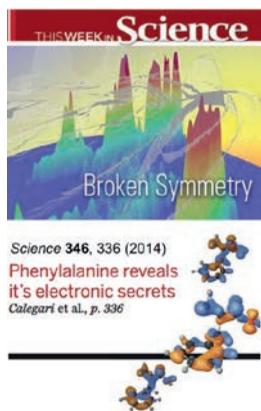
- Our work consists in the theoretical study of the dynamics in isolated quantum systems, from the smallest ones, such as in the interaction of atoms or small molecules with ultrashort laser pulses, to medium-sized systems, such as fullerenes and biomolecules, or extended systems, as in the interaction of molecules with metallic surfaces.
- Our aim is to produce theoretical predictions and interpretations that can lead to a better understanding of these systems, as well as to propose new experimental situations. For that we use state-of-the-art theoretical tools, both home-made and standard: from full-dimensional grid calculations for the hydrogen molecular ion to density functional theory for large molecules on metallic surfaces. In particular our work focuses on (i) the modeling of photoexcitation and photoionization processes in atomic and molecular systems induced by synchrotron radiation and ultrashort laser pulses with femto- and attosecond duration, and (ii) the study of materials and nano-objects composed of molecular systems, aggregates and fullerenes, isolated or deposited on metallic and nonmetallic surfaces.



Dr. Yang Wang

Postdoc

Universidad Autónoma de Madrid, Spain





Theoretical Study of Molecules on Surfaces

Prof. 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).

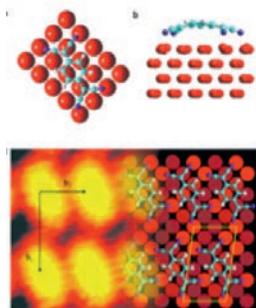
Research lines

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.



Alberto Martín
 Ph.D. student



Photonic STM

Dr. Roberto Otero

Associated Scientist

Ph.D.: Universidad Autónoma de Madrid, Spain

Double Affiliation: Universidad Autónoma de Madrid, Spain

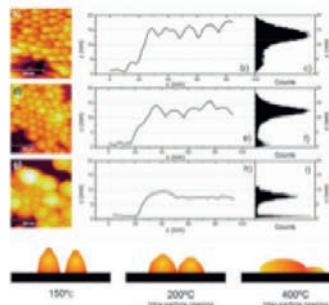
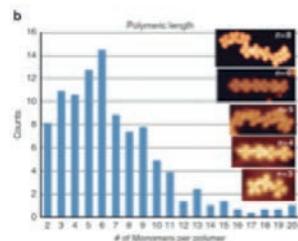
Researcher ID: E-4516-2011

Roberto Otero obtained his PhD in 2002 from Universidad Autónoma de Madrid, where he investigated the relations between the morphology of nanostructures and their electronic structure. In 2002 he moved to the University of Aarhus in Denmark as a Research Assistant Professor funded through a Marie Curie Fellowship under the supervision of Prof. Flemming Besenbacher. During his postdoctoral stage, Roberto Otero became interested in the self-assembly of organic molecules on solid surfaces, making important contributions to our current understanding of hydrogen-bonding at surfaces (*Angew. Chem. Intl. Ed.* 44, 2270 (2005), *Science* 319, 312 (2008)) and the diffusion of complex organic adsorbates (*Nature Materials* 3, 779 (2004)). In 2005, he joins Universidad Autónoma de Madrid as Ramón y Cajal tenor position, which became permanent in 2011, and in 2008 he was recruited by IMDEA Nanoscience as Associated Researcher.

Research Lines

The Photon STM group is currently developing several research lines, aiming at a) the fabrication of new nanostructures on solid surfaces starting from organic material, including graphene nanostructures and b) the electronic and optical characterization of such nanostructures with atomic resolution, by Scanning Tunnelling Microscopy, Spectroscopy and Luminescence.

1. 2D donor/acceptor molecular nanostructures: We have investigated the role of charge transfer on the adsorption, and self-assembly of organic molecules on solid surfaces [*Nature Chemistry* **2**, 374 (2010), *Chem Comm* **50**, 833 (2014)...]
2. New covalent chemical reactions at solid surfaces, including the synthesis of graphene nanostructures [*Nature Communications* **7**, 11002 (2016)].
3. Growth and physical properties of 2D coordinations networks on solid surfaces [*Small* **11** 6358 (2015)].
4. Attachment and characterization of colloidal semi-conducting quantum dots to solid surfaces [*ACS Nano* **7** 2559 (2013)].
5. Electrically induced light emission from individual organic molecules and nanostructures.





Structure and Reactivity of Mineral Surfaces

Dr. Carlos M. Pina Pimentel

Associated Scientist

Ph.D.: Universidad Complutense de Madrid, Spain

Double Affiliation: Universidad Complutense de Madrid, Spain

Carlos M. Pina got his Ph.D. in Geology from the Universidad Complutense de Madrid (UCM) in 1996. From 1997 to 2001, he was member of the research group directed by Professor Andrew Putnis at the Institute for Mineralogy at the University of Munster (Germany).

In 2001, Dr. Pina joined the Department of Crystallography and Mineralogy at the UCM as a “Ramon y Cajal” researcher and became lecturer in Crystallography and Mineralogy in 2005. Through his research, Dr. Pina has contributed to the study of the nanoscale processes occurring at the mineral-fluid interfaces. He has investigated the effect of the symmetry and the anisotropy on the nanoscale crystal growth mechanisms, the formation of solid solutions and epitaxial monolayers on mineral surfaces, and the effect of inorganic and organic impurities on the growth kinetics of minerals from aqueous solutions. At IMDEA, Dr. Pina is member of the Nanotribology group.

Research lines

- Crystal growth mechanisms operating on mineral surfaces.
- Formation and nanomanipulation of overgrowths on mineral surfaces.
- Structure of crystal surfaces in liquid environments.
- Interaction between multicomponent aqueous solutions and minerals.
- Relationships between crystallization kinetics and composition in solid solution-aqueous solution systems.

program

transport in 2d systems

Program Manager: Prof. Jose Luis Vicent

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 Center for Physical Techniques (CAI Tecnicas 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 Atomico 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 Espanola de Fisica). Professor Vicent has been 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 master and Ph. D. graduate students. Prof. Vicent publications cover a diversity of materials from single crystals to metallic glasses, and many different effects mostly related to magnetism and superconductivity at the nanoscale.

Research lines

- The Prof. Vicent research is focused on low dimensional superconductivity and magnetism, covering superlattices, magnetic metallic glasses, fabrication of magnetic and superconducting nanostructures, high temperature superconductivity, nanomagnetism, superconducting vortex physics, and hybrid magnetic/ superconducting nanostructures.

Graphene

Prof. Francisco Guinea

Pump-probe Photoinduced Absorption Spectroscopy

Dr. Juan Cabanillas-González

Electrical Conductivity of Single Molecules

Prof. Nicolás Agrait
 Dr. Teresa González

Nanostructured superconductors

Dr. Elvira M. González



Graphene

Prof. Francisco Guinea

Senior Researcher

Ph.D: Universidad Autónoma de Madrid

Previous Position: Instituto de Ciencia de Materiales de Madrid-CSIC, Spain

Researcher ID: A-7122-2008

Francisco Guinea obtained his BSc (1975) in Physics from the Universidad Complutense de Madrid, and the Phd at the Universidad Autónoma de Madrid (1980). He obtained a Fullbright Fellowship and worked at the University of California, Santa Barbara, during the years 1982-1984. He became Assistant Professor at the Universidad Autónoma de Madrid in 1985, and Senior Researcher at the Consejo Superior de Investigaciones Científicas in 1987. He has been visiting Professor at the University of Michigan, 1991-1992, and visiting Researcher at the University of California San Diego, 1997, and Boston University, 2004-2005. He has stayed for shorter periods at a number of institutions worldwide, like IBM Rüscliikon, Kernforschunganlage Jülich, DIPC, San Sebastián, ICTP, Trieste, ENS, Par's, and many more. He joined Imdea Nanoscience in January 2005.

F. G. has published over 400 scientific papers, with an h-index of 75 and more than 50 papers with over 100 citations. He has received a number of awards, including the biannual National Prize for Physics (Spain), and the Gold Medal of the Spanish Physical Society.

Research Lines

The group has varied interests in theoretical condensed matter physics and materials science. In particular, we focus on:

1. Novel properties and devices of graphene. Electronic and structural properties.
2. Optical and structural properties of two dimensional semiconductors, like transition metal dichalcogenides and black phosphorus.
3. Two dimensional superconductivity.



Dr. Luca Chirolli

Postdoc

Scuola Normale Superiore,
Pisa, Italy & ICMM-CSIC, Spain



Dr. Vincenzo Parente

Postdoc

Università degli Studi di Napoli
"Federico II" Italy & ICMM-
CSIC, Spain



Dr. Rafael Roldán

Postdoc

ICMM-CSIC, Spain



Dr. José Ángel Silva

ICMM-CSIC, Spain

Dr. Héctor Ochoa de Eguileor

Long-stay visitor Donostia
International Physics Center
Foundation (DIPC), Spain

Francesca Finocchiaro

Ph.D. student

Ángel Gutiérrez

Ph.D. student

Luis González Arraga

Ph.D. student



Electrical Conductivity of Single Molecules

Dr. Teresa González

Researcher

Ph.D.: Universidad de Santiago de Compostela, Spain

Previous Position: University of Basel, Switzerland

ORCID ID: 0000-0001-0002-7253-797X

Researcher ID: H-5527-2012

M. Teresa González got her Bachelor Degree (1996) and her PhD in Physics (2003) at the Universidad de Santiago de Compostela in Spain. Her PhD thesis obtained the Outstanding Doctorate Award. She is an expert in electrical transport properties of matter. She has worked in different fields including superconductivity, during is PhD research, and molecular electronics, that she started during her postdoctoral stay at Universität Basel in Christian Schönenberger's group (2004-2008). She joined IMDEA-Nanociencia in 2008 as Ramón y Cajal researcher. She is in charge of the IMDEA Molecular Electronics Laboratory.



Dr. Edmund Leary

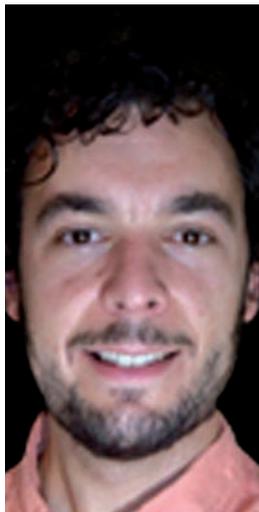
Postdoc

University of Liverpool, UK

We study the properties of single-molecule junctions formed using scanning tunneling microscopes that are designed and developed in house. We focus on junctions with molecules **chemically bound to two metallic electrodes**.

1. **Electrical properties** of organic molecule families: oligo(phenyl ethynylene)s, oligoynes, phthalocyanines, porphyrins... (JACS 2013, JACS 2014, JACS 2015...)
2. **Thermopower** of single-molecule junctions: we explore to ability to a single molecule of different compounds to generate an electrical potential when they are under a thermal gradient (Nano Lett. 2013, Nature Mater. 2016, Chem. Soc. Rev. 2016).
3. Key factors involved in the **formation and stability** of molecular junctions (J. Chem. Phys. C 2013, J. Am. Soc. 2013, Chem. Soc. Rev. 2015...).
4. **Fullerene**-based molecular junctions (Nano Lett. 2011, JOC 2014).
5. **Graphene** as electrode for molecular electronics.
6. Molecular junctions under **electrochemical control**.





2D Materials

Dr. Andrés Castellanos-Gómez

Researcher

Ph.D: Universidad Autónoma de Madrid. Spain

Previous Position: Delft University of Technology, the Netherlands

Google Scholar: <https://scholar.google.es/citations?user=zVHHJMAAAAAJ&hl=en>

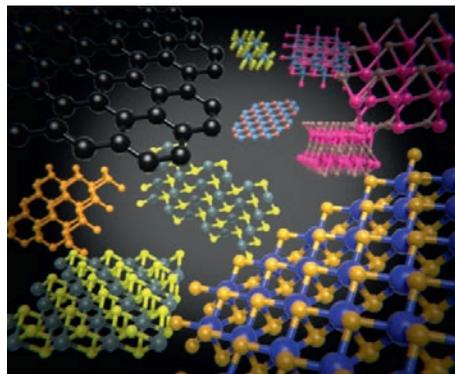
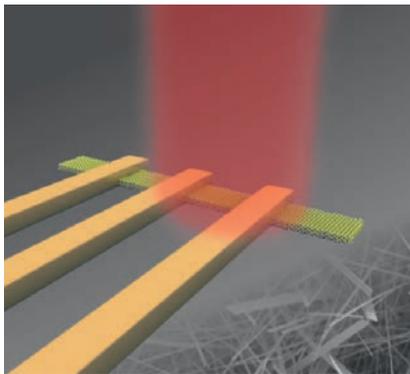
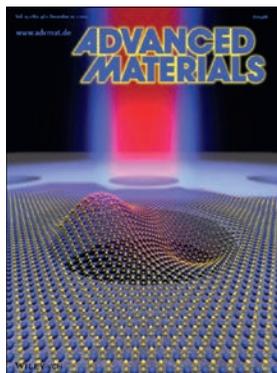
Group webpage: <https://sites.google.com/site/2dmaterialsanddevicesgroup/home>

Andres Castellanos-Gomez obtained his Physics Degree from the Universidad Complutense of Madrid in 2006. His PhD (Cum Laude and “Extraordinary Award”, 2011) was carried out at the Condensed Matter Department of the Autónoma University of Madrid. His PhD work was devoted to the study of the electrical and mechanical properties of atomically thin materials by scanning probe microscopy techniques. During his postdoctoral stay (2011 - 2015) at the internationally renowned Kavli Institute of NanoScience in Delft University of Technology (The Netherlands) he was in charge of the research on optoelectronic and optomechanic properties of nanodevices based on 2D materials in Prof. Herre van der Zant’s group. In 2015 A.C-G. joined IMDEA Nanoscience as a researcher and since 2016 he is Ramon y Cajal fellow. He received the Young Researcher Award 2012/2013 given by the Grupo Español del Carbón, the Young Researcher Award 2013 given by the Instituto Universitario de Materiales (Alicante University) and the Joseph Wang Award 2015 for Young Researchers in Nanoscience by the Cognizure publishing group.

Research Lines

The research in our group focusses on the optoelectronic properties of two-dimensional materials:

1. Isolation and characterization of novel and unexplored 2D materials (2D Mater 2014, Adv Mater 2015).
2. Optoelectronic devices based on 2Ds: we study the physical properties of photodetectors, photodiodes and solar cells based on atomically thin materials (Nano Lett 2014, Nano Lett 2015, Nature Comm 2015,...).
3. Strain engineering: we are very interested in tailoring the optical and electronic properties of 2D materials by means of mechanical deformations (Nano Lett 2013, Nanoscale 2015, Nano Lett 2016,...).





Simon Svatec
Ph.D. student

Electrical transport in Nanosystems

Prof. Nicolás Agraït

Associated Senior Scientist

Ph.D: UNED, Spain

Double Affiliation: Universidad Autónoma de Madrid, Spain

ORCID ID: 0000-0001-8177-7919

Researcher ID: I-2207-2012

Nicolás Agraït has been full professor in Physics at the Universidad Autónoma de Madrid (UAM) since 2006 and associated senior researcher of IMDEA since 2008. He has developed state-of-the-art scanning probe techniques for studying transport in the nanoscale and performed pioneering studies of transport in nanocontacts, atomic contacts, freely-suspended atomic wires and single-molecule junctions, including mechanical properties, electron-phonon interaction, and thermopower, using scanning probe techniques. He has over 90 refereed publications with over 5800 citations; his h-index is 29 (ISI WoS).

We study the properties of single-molecule junctions formed using scanning tunneling microscopes that are designed and developed in house. We focus on junctions with molecules **chemically bound to two metallic electrodes**.

1. **Electrical properties** of organic molecule families: oligo(phenyl ethynylene)s, oligoynes, phthalocyanines, porphyrins... (JACS 2013, JACS 2014, JACS 2015...)
2. **Thermopower** of single-molecule junctions: we explore the ability of a single molecule of different compounds to generate an electrical potential when they are under a thermal gradient (Nano Lett. 2013, Nature Mater. 2016, Chem. Soc. Rev. 2016).
3. Key factors involved in the **formation and stability** of molecular junctions (J. Chem. Phys. C 2013, J. Am. Soc. 2013, Chem. Soc. Rev. 2015...).
4. **Fullerene**-based molecular junctions (Nano Lett. 2011, JOC 2014).
5. **Graphene** as electrode for molecular electronics.
6. Molecular junctions under **electrochemical control**.



Nanostructured superconductors

Dr. Elvira M. González

Associated Scientist

Ph.D: Universidad Complutense de Madrid

Double Affiliation: Universidad Complutense de Madrid

Physics from Universidad Complutense de Madrid (UCM) in 1998 with a work on high- T_c superconducting films and superlattices, which was awarded with the Premio Extraordinario de Doctorado. She worked on structural characterization of superlattices at University of California San Diego with Prof. Ivan K. Shuller. After this, she worked on magnetotunneling in 2DEG with Prof. Emilio E. Mendez in the University of New York at Stony Brook with a NATO postdoctoral fellowship. In 2001, she got a Ramon y Cajal research fellow at Facultad de Ciencias Físicas (UCM) to work in the fabrication of ordered nanostructures. Currently, she is Associated Professor in the Departamento de Física de Materiales (UCM) and in 2013 she joined IMDEA-Nanociencia as an Associated Scientist.

Research lines

- Fabrication and structural characterization of nanostructures.
- Transport and magnetic properties of superconducting/magnetic hybrids.
- Low temperature properties of mesoscopic systems.



program

nanomagnetism

Program Manager: Dr. Julio Camarero

Associated Senior Scientist

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 Neel-CNRS France (Marie-Curie Fellow and scientific contracts) before returning to UAM in 2003 as Ramon y Cajal research fellow. JC is currently Associate Professor of the Condensed Matter Physics Department. In 2008 he joined IMDEA Nanoscience as Associated Senior Scientist, leading the Nanomagnetism Program.

JC has coordinated National Regional and European projects and has published more than 80 peer-reviewed papers (> 1600 cites, h-index: 22) 11 book chapters, 4 invited papers, and 1 EU patent. 25 invited talks at international conferences (150 other conference presentations). JC is a frequently invited scientist in different Synchrotron Radiation Facilities.

Research lines

- The current scientific interest of Dr. Julio Camarero includes the preparation and characterization of artificial magnetic (inorganic and organic) nanostructures, as well as the development of novel experimental techniques. Particular attention is devoted to studies on quasi-static and dynamic magnetization reversal processes and magnetoresistive responses. His goal is to acquire a better understanding of the fundamental physics of new functional properties of magnetic nanostructures that are important, or may become important, for applications in information-storage, spintronics, and biomedicine areas.

SpinOrbitronics

Dr. Paolo Perna

Permanent Magnets

Dr. Alberto Bollero

Advanced Magneto-Optics

Dr. Alberto Bollero

Epitaxial Growth

Dr. Miguel Ángel Niño

Growth & Nanostructuring

Dr. Feng Luo

Dynamics

Dr. Francisco Terán



Growth & Nanostructuring



Dr. Feng Luo

Senior Researcher

Ph.D.: Peking University, China

Previous Position: Peking University, China

Feng Luo obtained his BSc (1999) supervised by Prof. Zhongfan Liu, and then joined Prof. Chunhua Yan's research group and 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) as junior group leader of Multi-Functional Devices by Interface Control and Nanoengineering and hold Ramón y Cajal grant since 2014. From 2014 he was promoted to Senior Researcher.

Research Lines

The group has varied interests in the nanofabrication and 2D devices. In particular we are active in:

1. Nanomagnetism and spintronics:
 - a) Low dimensional magnetic nanocrystalline materials and bit patterned magnetic recording media for ultra-high density magnetic recording.
 - b) Correlation between the microstructure and magnetic properties in hard magnetic thin film materials for magnetic head.
 - c) Magnetostrictive/ferroelectric ultra-thin film composites and devices (magnetic sensor an energy harvester and so on).
 - d) Synchrotron based x-ray magnetic imaging and magnetization reversal.
 - e) Magneto-plasmonic effect of Au/Co/Au nanoring based structures by Hole mask colloidal lithography and e-beam lithography.
2. Micro and nano-fabrication technology:
 - a) Methodology of semiconductor micro and nanofabrication for graphene devices.
 - b) Electron beam, laser, ultra violet and nanoimprint lithographys for device fabrication.
3. Graphene or other 2D materials based devices combined with magnetic metals.



Dr. Rubén Guerrero

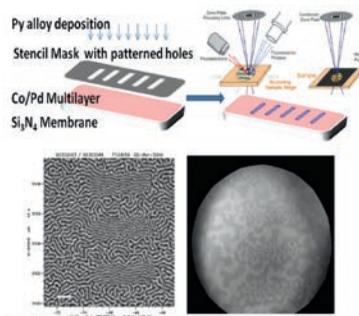
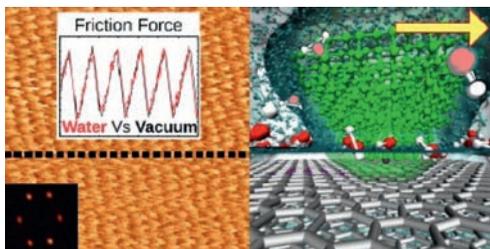
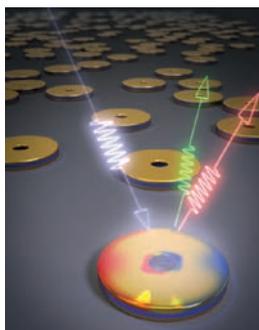
Postdoc

Institut d'Electronique
Fondamentale (IEF) Universite
Paris- Sud, France

Hauyu Feng

Ph. D. student

(Beijing Normal University,
China)





Epitaxial Growth

Dr. Miguel Ángel Niño

Researcher

Ph.D.: Universidad Autónoma de Madrid, Spain

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

Researcher ID: M-2571-2014

Miguel Angel Niño obtained his MSc (1997) in Solid State Physics from the Universidad Autónoma de Madrid (UAM). He joined in 2000 the group of Prof. R. Miranda at the Surface Science Laboratory of UAM where he obtained his PhD in 2006. He then moved to the group of Prof. Maya Kiskinova and A. Locatelli at the Nanospectroscopy beamline in Elettra Synchrotron in Trieste (Italy), performing synchrotron radiation based spectromicroscopy. In 2011 he joined IMDEA Nanoscience as researcher, in the frame of Marie Curie program, to set the Molecular Beam Epitaxy Growth Laboratory and the surface spectroscopy analysis system.

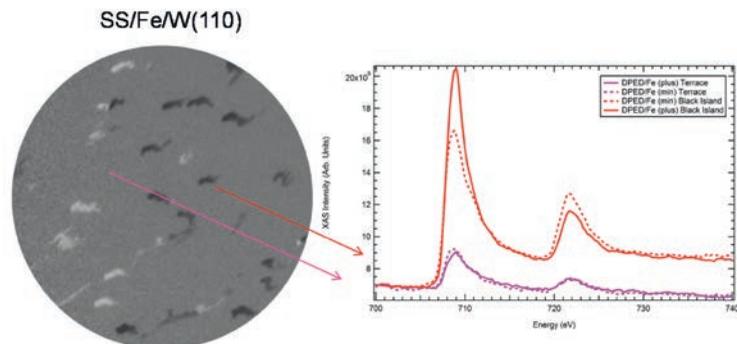
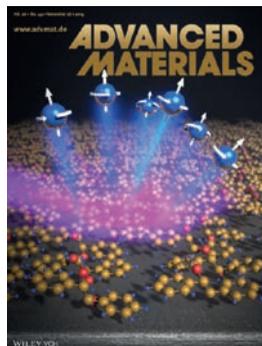
Research Lines

The MBE group has different interests in the Surface Science: spectroscopy, chemical reactivity, growth of thin films and nanomagnetism. The MBE laboratory has several UHV systems to perform surface studies with XPS, UPS, LEED, TDS, as well as different in-situ UHV growth techniques (MBE, magnetron sputtering) for metals, oxides and molecular organic materials. In particular we carry out projects in:

1. Chirality and magnetism: We study the interplay between the chirality and spin filtering effects of thin molecular films.
2. Surface reactivity: We are interested in the role of metallic sulphide surfaces in the synthesis of organic molecules in prebiotic chemistry. We study catalytic process on ferroelectric surfaces and molecular adsorption.
3. Functionalization and characterization of 2D materials: In collaboration with the 2D Materials Group of Imdea, we carry the characterization with local and non-local photoemission spectroscopy of the electronic structure of 2D systems, and its functionalization with organic molecules deposited by MBE.
4. Growth of molecular films: We study the improvement of surfaces and interfaces on thin films of organic materials for solar cell. The development of new metal-organic magnetic materials and the influence of anisotropy in its magnetic properties.

Fernando Ajejas

Ph.D. student





SpinOrbitronics

Dr. Paolo Perna

Researcher

Ph.D.: University of Caen Basse- Normandie, France & University of Cassino, Italy

Previous Position: CNR-SPIN, Italy

Researcher ID: C-3862-2012

Group webpage: <https://sites.google.com/site/spinorbitronics/>

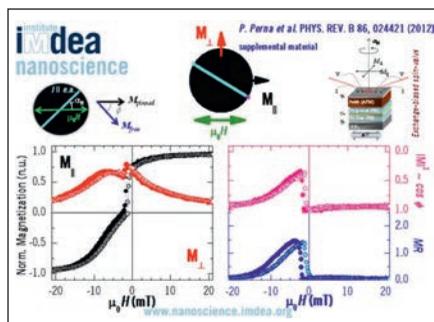
Paolo Perna obtained his BCs + MCs in theoretical Physics on 2003 from the University Federico II in Naples (Italy) and then moved to the experimental research. On 2008, he obtained two PhD titles in Physics: Condensed Matter and Devices from the University of Caen Basse-Normandie (France) and in Mechanical Engineering (Material Science) from the University of Cassino (Italy). During his PhD, he has been granted of an individual exchange fellowship from the European Science Foundation (2006). After a postdoctoral research contract at the CNR-SPIN in Naples (Italy), on 2009 he joined the Nanomagnetism's group at IMDEA Nanoscience within the Marie Curie AMAROUT fellowship program and, on 2011 he obtained a Juan de la Cierva fellowship. Actually, PP is researcher at IMDEA Nanoscience leading the SpinOrbitronic group. He is responsible of the Advanced Magneto Optics Lab and of the Sputtering facility of the Multi-purpose UHV growth/spectroscopy Lab.

His research activities cover both fabrication and characterization of magnetic and non-magnetic systems focusing on their fundamental properties and potential technological applications. In particular, his research is mostly dedicated to the understanding and realization of novel spintronics and spinorbitronic devices by employing materials with tailored interface functionalities.

Research Lines

The group focuses the interests on solid state physics and material science of low dimensional magnetic materials, covering epitaxial growth, surface/interface and magnetotransport characterization, nanofabrication. In particular:

- 1. Disentangling magnetoresistance responses in magnetic nanostructures:** magnetization reversal vs. spin-dependent transport; magnetic anisotropies (in-plane vs. perpendicular); Magnetoresistive effects: AMR, GMR, CMR, Spin Hall effects; Symmetries and asymmetries of Spin-Orbit effects.
- 2. Development of new hybrid (inorganic-organic) magnetic nanostructures:** growth of artificial magnetic nanostructures; molecular spintronic and graphene-based magnetic nanostructures; exchange bias, spin valves, tunnel junctions, perovskite oxides.
- 3. Functional oxide interfaces:** high-k dielectric, half-metallic, ferroelectric and multiferroic perovskites.
- 4. Polarization dependent element-resolved x-ray spectroscopy and microscopy studies:** X-ray magnetic circular/linear dichroism, XMCD/XMLD, & resonant magnetic reflectivity, XRMR X-ray photoemission electron microscopy, magnetic holography imaging.



Video: <https://youtu.be/-o-V-LtBFlo>

Sergio de las Heras
 Technician

program

nanoscience for critical raw materials

Program Manager: Dr. Alberto Bollero

Senior Researcher & Head of Division of Permanent Magnets and Applications

Group webpage: <http://www.nanoscience.imdea.org/division-permanent-magnets-applications>



Dr. Alberto Bollero is Coordinator of the Research Programme “Nanoscience for Critical Raw Materials” at IMDEA and Head of the Division of Permanent Magnets and Applications. He obtained his PhD degree in 2003 in Physics by the Technical University of Dresden (Germany). Afterwards he did a postdoctoral stay at the University of Leipzig and, in 2005, he was Marie Curie Fellow at SPINTEC (CEA-Grenoble) in Bernard Dieny’s group. He got in 2012 the “I3 Certification” for scientific and technological excellence by Spanish Ministry MINECO and settled the department that he is leading since then at IMDEA.

Researcher’s activity at IMDEA has resulted in several scientific and technological initiatives with 6 projects with the researcher as Coordinator during last 3 years. These projects position A. Bollero as P.I. on research projects that total over 5 M€. He has above 70 publications in peer reviewed journals and contributions to more than 90 international scientific conferences. During last 5 years, A. Bollero has obtained 2 Awards in International Conferences and 3 Patents.

Very recently he has been invited speaker at 2015 MRS Fall Meeting (Boston, USA), 2016 E-MRS (Lille, France) and 2016 EMN Meeting (Croatia) to present latest advances and applications of rare earth-free permanent magnets.

Rare-Earth free Permanent Magnets

Dr. Alberto Bollero

Energy Harvesting

Dr. Juan Cabanillas-González

Multifunctional Materials

Recycling

program

nanoscience for critical raw materials



Dr. Eva Céspedes

Postdoc
Institute for Science and
Technology in Medicine-Keele
University, UK



Dr. Jiayan Law

Postdoc
Chalmers University of
Technology Gothenburg,
Sweden

**José Luis Fernández
Cuñado**

Ph. D. student

Francisco Javier Pedrosa

Ph. D. student

Karol Golasinski

Ph. D. student
(Warsaw University of
Technology, Poland)

Javier Rial

Research assistant

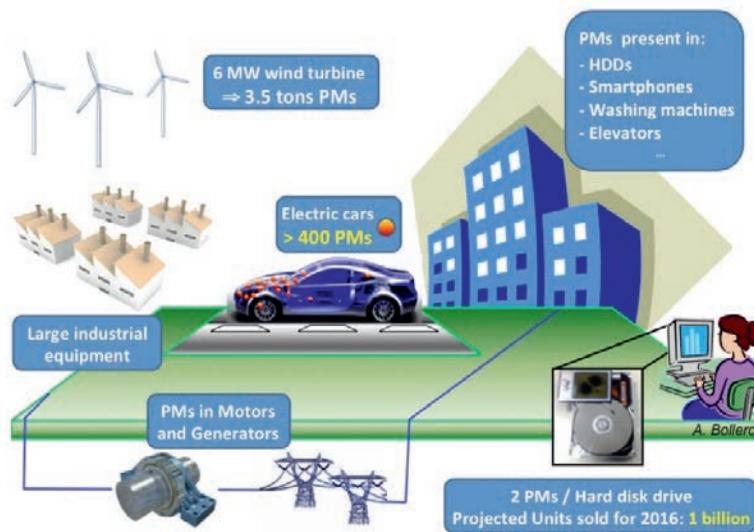
Noelia Lopez

Technician



Dr. Cristina Navio

Postdoc
Mons University, Belgium





program

nanomedicine

Program Manager: Prof. Rodolfo Miranda

Synthesis of magnetic nanoparticles

Dr. Gorka Salas

NanoOncology

Dr. Cristóbal Belda M.D.

Dr. Ángel Ayuso

Hyperthermia

Dr. Francisco Terán

Dr. Daniel Ortega

Metalldrugs

Dr. Ana Pizarro

**Nucleic Acids and Nanoparticles
in Nanomedicine**

Dr. Álvaro Somoza



Nucleic Acids and Nanoparticles in Nanomedicine

Dr. Álvaro Somoza

Senior Researcher

Ph.D.: Universidad Autónoma de Madrid, Spain

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

Group webpage: www.nanobioimdea.com

Álvaro Somoza studied Chemistry at Universidad Autónoma de Madrid where he did his Ph.D., 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 using 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. In 2009, he joined IMDEA Nanoscience and was promoted to Senior Scientist in 2015.

Research Lines

- The research of Dr. Somoza is focused on the preparation of modified oligonucleotides and functionalization of nanoparticles for different biomedical applications, such as the detection and treatment of Uveal Melanoma, Pancreatic and Breast Cancer and Duchenne Muscular Dystrophy. Particularly, modified nucleic acids are conjugated to nanoparticles for the regulation and detection of relevant genes and microRNAs involved in those diseases. Some of the sensing systems aim to work with *ex vivo* samples (RNA extracts) without the need of any equipment. Here, a change in the colour of a solution will confirm the presence of the disease.
- For the treatment of the diseases, the nanostructures are also functionalized with different drugs and targeting molecules to improve their efficacy as nanomedicines. In this case, the aim is also to build robust and selective systems that can be translated to *in vivo* experiments.



Dr. Alfonso Latorre

Postdoc

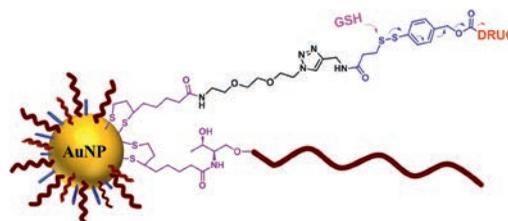
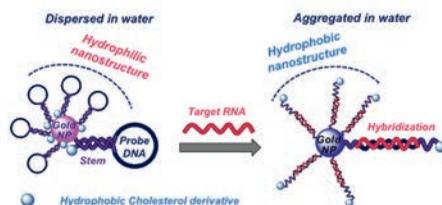
Universidad Autónoma de Madrid, Spain

Siamak Javani

Ph.D. student

Romina Lorca

Ph.D. student





Engineering Biofunctional Nanostructures

Dr. Aitziber L. Cortajarena

Senior Researcher

Ph.D.: Universidad del País Vasco, Spain

Previous Position: Yale University, USA

Dr. Aitziber 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, with Dr. G. Haran working on single molecule spectroscopy. Then, continued her work at Yale University, as an Associate Research Scientist with Dr. Regan. She joined IMDEA Nanociencia as Group Leader in 2010 to established her independent research group focused on protein engineering toward the generation of bio-functional nanostructures and bioinspired materials for applications in nano-biotechnology and nanomedicine. In 2016, she joined CIC-BiomaGUNE in 2016 as Ikerbasque Research Professor to lead the Biomolecular Nanotechnology group focused on the development of modular versatile platforms for the fabrication of multiple protein-based hybrid functional materials. She holds an Associate Scientist position at IMDEA-Nanociencia.



Dr. Pierre Couleaud

Postdoc

CNRS Nancy University,
France

Sara H. Mejías

Ph.D. student

David Romera

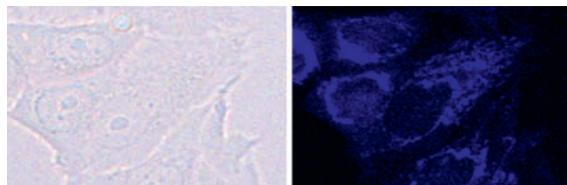
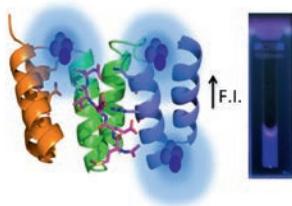
Ph.D. student

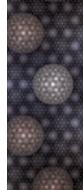
Research Lines

The group has varied interests at the interface of biochemistry, bioconjugation, functional materials and nanomedicine.

The two main research lines of the group are:

1. Bio-functionalization of nanoparticles for biomedical applications
 The objective of this research line is the generation of versatile functional nanoparticles with a selection of biomolecules and optimized properties for targeting and diagnosis of several diseases. In this context, multifunctional nanoparticles are utilized as drug carries and as sensors for *in vivo* and *ex-vivo* applications (J Mat Chem B 2015, Breast Cancer Res. 2015, Nanotechnology 2016)
2. Biomolecular design for functional nanostructures and biomaterials
 In this research line we use mainly proteins as platforms for the fabrication of multiple protein-based hybrid functional nanostructures and biomaterials for their use in different technological and biomedical applications. We combine engineering and bioconjugation methodologies to produce molecular hybrids that will be the basis of functional materials and devices (Nanoscale 2014, Biomacromolecules 2015, ACS Applied Mat Interfaces 2016).





Magnetic Nanoparticles in Biomedical Applications

Dr. Francisco Terán

Researcher

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

Previous Position: Centro Tecnológico Gaiker.Fundacion Gaiker. Spain

Researcher ID badge: <http://www.researcherid.com/rid/F-1285-2010>

Researchgate profile: https://www.researchgate.net/profile/Francisco_Teran

Google Scholar profile: <https://scholar.google.es/citations?user=dE6-ReMAAAAJ&hl=es&authuser=1>

Scopus profile: <https://www.scopus.com/authid/detail.uri?origin=resultslist&authorId=6701635309&zone=>

Francisco J. Terán graduated in Physics in 1997 at Universidad Autónoma de Madrid. Immediately after, he joined the group of Marek Potemski at the Grenoble High Magnetic Field Lab CNRS-MPI/FKF for starting his thesis work on “Spin Dependent Phenomena in n-type doped semimagnetic semiconductor quantum well structures”. In November 2001, he obtained his PhD degree. On March 2002, Dr. Teran moved to the Quantum Transport group led by Prof. Laurence Eaves at the University of Nottingham as research associated. On September 2003, Dr. Teran come back to Grenoble High Magnetic Field Lab CNRS-MPI/FKF as “chercheur associé”. On March 2005, Dr.Teran joined SemicUAM group at Universidad Autónoma de Madrid to work with Prof. José Manuel Calleja as Juan de la Cierva fellow. On March 2007, Dr. Teran moved to IK4-Gaiker Technological Center as Senior researcher (2008 Torres Quevedo fellowship). On April 2009, Dr. Terán joined IMDEA Nanociencia (since 2012 as a Ramón y Cajal fellowship) to strength the research line on magnetic nanoparticles for biomedical applications. From 2010 to 2013, Dr. Teran led the AFM Service. Since 2012, Dr. Teran led the Hyperthermia Lab and since 2014, Dr. Teran led the Instrumentation Service.

David Cabrera

Technician

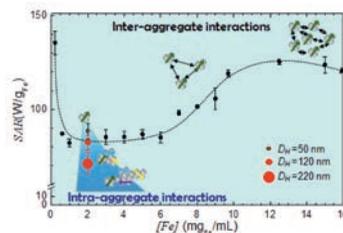
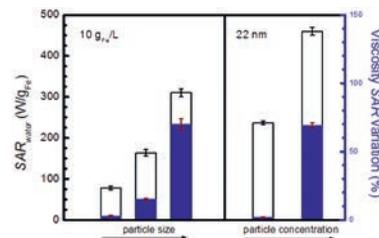
Emilio Artés

Technician

Research Lines

The Hyperthermia Lab focuses his research activities on the physical phenomena related to magnetic nanoparticles subjected to alternating magnetic fields and its biomedical application. In particular, we are highly active in:

1. The study of the influence of intrinsic (size, chemical composition) and extrinsic (field conditions, aggregation, concentration, viscosity,etc..) parameters on the AC magnetic response of magnetic nanoparticles (Salas et al. J. Phys. Chem. C 2014, Ovejero et al. Phys. Chem.Chem.Phys. 2016).
2. The study of the influence of biological matrices and fluids on the AC magnetic response of magnetic nanoparticles (Aires et al. J. Mat. Chem B 2015).
3. The use of magnetic nanoparticles as magnetic transductor for sensing molecular markers in human plasma.
4. 4) The development and validation of instrumentation for advanced magnetic measurements (<https://sites.google.com/site/servin-simdeanano/home>).





Synthesis of magnetic nanoparticles

Dr. Gorka Salas

Researcher

Ph.D.: Universidad de Valladolid, Spain

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

ORCID: <http://orcid.org/0000-0002-5355-1477>

Researcher ID: M-2571-2014

After his degree in Chemistry, **Gorka Salas** completed his PhD (2007) at the Universidad de Valladolid, under the supervision of Prof. Pablo Espinet and Juan A. Casares. His work during that time was focused in the field of organometallic chemistry and homogeneous catalysis, particularly in the mechanistic study of C-C bond forming reactions. In 2008 he moved to the group of Bruno Chaudret and Karine Philippot (Laboratoire de Chimie de Coordination-CNRS, Toulouse) and the laboratory of Catherine C. Santini (Laboratoire de Chimie Organometallique de Surface-CNRS, Lyon). There he studied the synthesis of metallic nanoparticles in ionic liquids and their use in catalytic hydrogenations.

Since 2011, he works at IMDEA Nanociencia in the synthesis of magnetic nanoparticles mainly, but not only, for biomedical applications. Since 2012 he is in charge of the Laboratory of Synthesis of Magnetic Nanoparticles where research is done in close collaboration with chemists, physicists, biochemists, biologists from academia and industry.

The lab is currently working in:

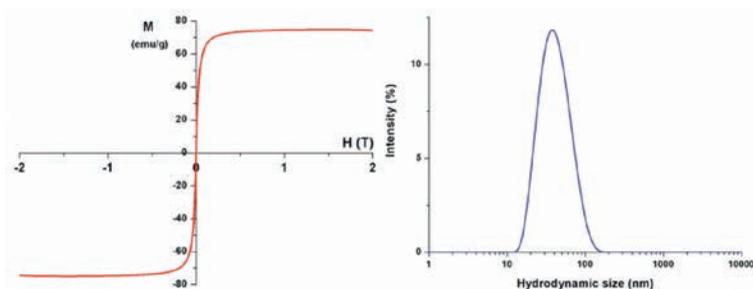
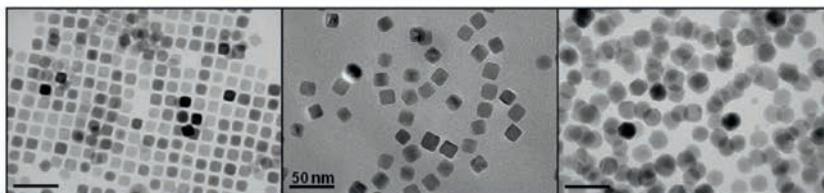
1. Synthesis, modification and characterization of magnetic nanoparticles for biomedical applications.
2. Nanoparticles for the oil & gas industry.

Rebeca Amaro

Technician

Leonor de la Cueva

Technician





Hyperthermia

Dr. Daniel Ortega

Researcher

Ph.D.: University of Cadiz, Spain

Previous Position: University College London, United Kingdom

ORCID: <http://orcid.org/0000-0002-5355-1477>

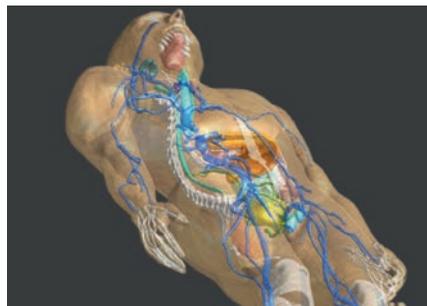
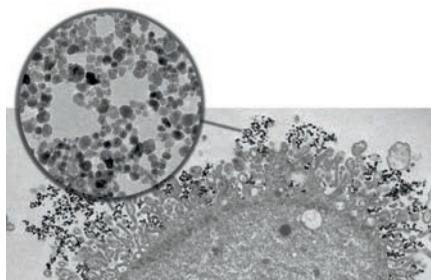
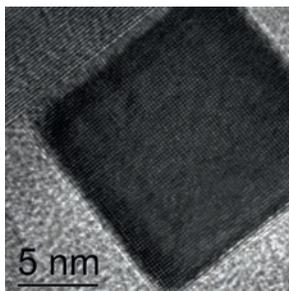
Researcher ID: M-2571-2014

Daniel Ortega received his MSc (2003) and PhD (2007) at the University of Cádiz supervised by Manuel Domínguez and Milagrosa Ramírez, undertaking his first postdoctoral position at the University of the Basque Country in 2008 working with José S. Garitaonandia and Fernando Plazaola. Starting in 2009, he joined The Royal Institution of Great Britain and University College London to work with Quentin Pankhurst, first as an Intraeuropean Marie Curie postdoctoral fellow and thereafter as a research associate. During this period he was awarded an honorary research associate position at the London Centre for Nanotechnology. He was appointed to the Toyohashi University of Technology in 2013 as research associate to Adarsh Sandhu's lab. Since late 2013 he joined IMDEA Nanoscience through a Marie Curie action, also holding an honorary position at the UCL Institute of Biomedical Engineering. Daniel currently belongs to the CNB-IMDEA Nanoscience Associated Unit.

Research Lines

The group is focused in bespoke magnetic nanoparticles with applications in biomedicine. More specifically:

1. Magnetocaloric nanomaterials. We work in the design and exploitation of magnetocaloric nanomaterials for distinct therapeutic and diagnostic applications: cardiovascular diseases, drug delivery, molecular detection, etc.
2. Other magnetic nanomaterials. We are also interested in a wide range of other magnetic nanomaterials applied to biomedicine; for example, magnetic hyperthermia to treat localised cancers by heat generation through hysteretic losses under AC fields.
3. *In silico* clinical trials. We are developing a treatment planning software for clinical magnetic hyperthermia.





Metalloodrugs

Dr. Ana Pizarro

Researcher

Ph.D.: Universidad Autónoma de Madrid, Spain

Previous Position: University of Warwick (UK)

Name of P.I.: Ana M. Pizarro

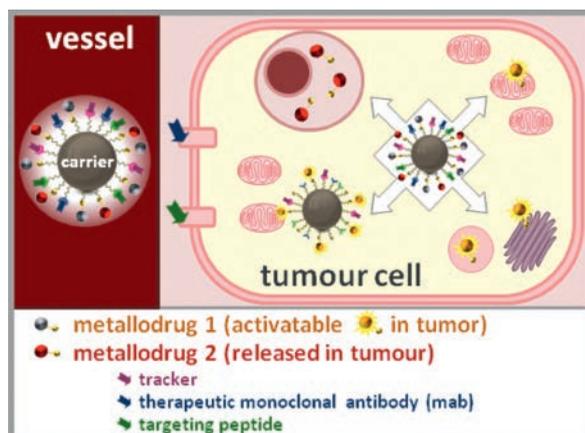
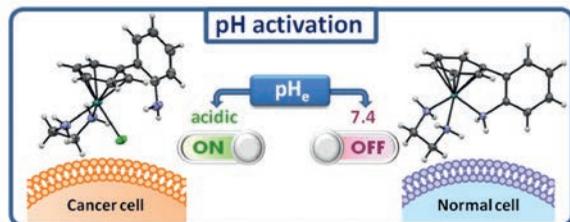
Ana M. Pizarro completed a PhD in Chemistry at the Universidad Autónoma de Madrid in 2004 under the supervision of Prof. C. Navarro-Ranninger, working on *trans*-platinum drugs. In 2004 she was awarded a Marie Curie Fellowship (EIF) to work in the laboratory of Prof P. J. Sadler FRS at the University of Edinburgh (UK) on new organometallic ruthenium drugs. She moved to the University of Warwick (UK) in 2007 where she focused on how selected metalloodrugs (based on ruthenium, osmium and iridium) exert their anticancer effects in tumour cells. In January 2014 she joined IMDEA Nanoscience as a Ramón y Cajal Fellow where she has established her research group. She also coordinates the Cell Culture Unit at IMDEA Nanoscience.

Research Lines

- Our ultimate goal is to generate metal-based drugs whose mechanism of action is understood and whose targets are identified. These metallo-medicines will exploit the extraordinary features of transition metal complexes, in particular the capability for in tumour activation (for example, pH-responsive systems), as well as the potential to generate oxidative stress through biocatalysis.
- We are also interested in exploring the possibility of loading our cancer modulating metallo-drugs into different types of nanocarriers - from plant-generated virus-like nanoparticles to rare-earth up-converting nanosystems - in order to confer control on the drug's release and reactivity.

Francisco Martínez

Ph.D. student





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. Angeles 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 heatcontrolled 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.

Macarena Calero

Ph .D. student



NanoOncology

Dr. Ángel Ayuso-Sacido

Associated Scientist

Ph.D.: Merck Sharp and Dhome

Spain Double Affiliation: Hospital de Madrid Foundation, Spain

Dr. Ayuso-Sacido made his PhD at Merck Sharp and Dhome (MSD) and worked as a postdoctoral fellow within the Medicine Department at Mount Sinai School of Medicine and the Neurosurgery Department at Cornell Medical Center. He came back to Spain and worked as Senior Researcher at Centro de Investigación Príncipe Felipe (CIPF) de Valencia and co-founded the Glioblastoma Spanish Network (REIG). Afterwards, he was Visiting Scientist at Helsinki University and currently, he is the Director of the Brain Tumour Laboratory at Hospital de Madrid Foundation, Associated Scientist at CEUSan Pablo University and IMDEA nanoscience and President of the REIG.



Dr. Sandra Milena Ocampo

Postdoc

Instituto de Química Avanzada
 de Cataluña (IQAC-CSIC)

Barcelona, Spain

Noemí García

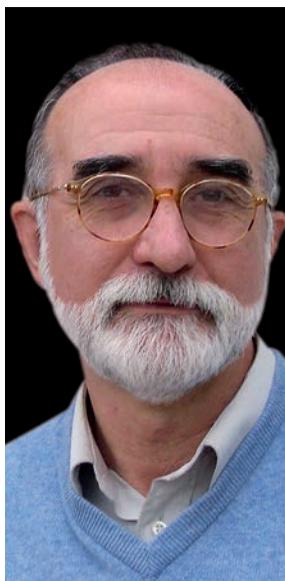
Ph.D. student

program

nanobiosystems

Program Manager: Prof. J.L. Carrascosa

Double Affiliation: Unidad de Nanobiotecnología. Joint Unit IMDEA Nanociencia-CNB-CSIC



Prof. Carrascosa is Research Professor of the CSIC and head of a research line in 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 more than 220 publications with an H index of 46. 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 ERAInstruments (2008-2011), among others. He is President of the Spanish Microscopy Society (2012-2016), and 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.

Optical Nanomanipulation

Dr. Ricardo Arias-González

**Super Resolution Fluorescence/AFM
Microscopy**

Dr. Cristina Flors

Protein Engineering

Dr. Begoña Sot

Optical and Magnetic Tweezers

Dr. Borja Ibarra

**Mechanical properties
of Biostructures**

Dr. Johann Mertens

Protein Biophysics

Prof. Víctor Muñoz



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

English: www.ariasgonzalez.com/home.html

Spanish: www.ariasgonzalez.com

J. Ricardo Arias-Gonzalez 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 (ICMM-CSIC), Madrid, and short stays in the National Institute of Standards and Technology (NIST, Gaithersburg, MD), EMBL-Heidelberg and École Centrale Paris, 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 joined the National Centre of Biotechnology (CNB-CSIC), Madrid, where he developed a state-of-the-art optical tweezers and a subsequent experimental environment for single-molecule Biophysics. Since 2008, he has been working in IMDEA Nanoscience, leading of the Optical Nanomanipulation Lab.

Irene Gutiérrez

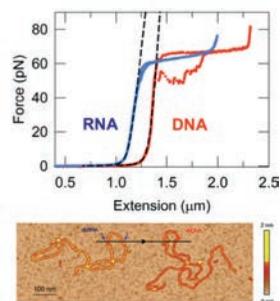
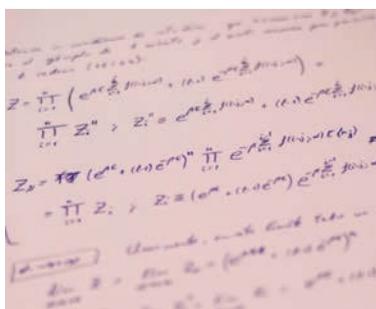
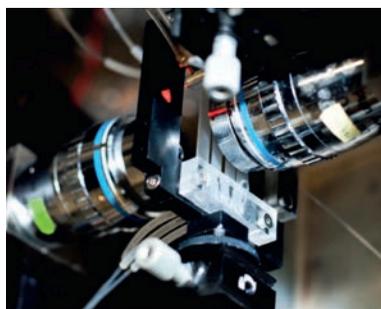
Ph.D. student

Héctor Rodríguez

Ph.D. student

Research Lines

- Dr. Arias-Gonzalez is working in the field of Molecular Biophysics, furthering the study of the macromolecules that make up the machinery of cells. He also investigates biocompatible nano-systems from the point of view of both Mesoscopic Physics and Biological Chemistry. He uses theory and experiments based on the optical manipulation of single specimens. His team is currently involved in the understanding of structural transitions of nucleic acids, including non-canonical conformations, molecular motors related to information processing and functional nanoparticles that may be used in Nanomedicine. He is also interested in the development of biophysical techniques for these research purposes.





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

Researcher ID badge:

Group webpage: <http://www.borjaibarralab.com>

Borja Ibarra (BSs in Biochemistry) obtained his PhD. in Molecular Biology from Universidad Autónoma Madrid in 2001. He made the 'leap' to molecular biophysics as a postdoctoral fellow in Prof. Carlos Bustamante lab at UC Berkeley (USA) where he learned to generate, analyze and interpret single molecule data on complex, multi-state biological systems. Back in Spain in 2007, he applied single molecule manipulation methods as optical tweezers at the CNB-CSIC (Madrid) to study biological molecular motors at single molecule level. He joined the Nanobiosystems research line at IMDEA Nanoscience in 2010, where he started the Molecular Motors Nanomanipulation Lab.

Research Lines

Our laboratory combines biochemical, molecular biology, single-molecule (optical tweezers) and theoretical modelling techniques to unravel the mechanistic aspects of biological molecular motors. Due to the highly interdisciplinary nature of the single molecule research field we successfully established a series of collaborations with national and foreign scientists from different. Our research lines include:

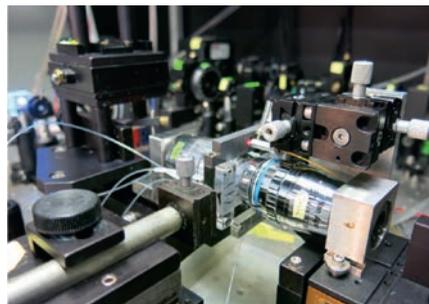
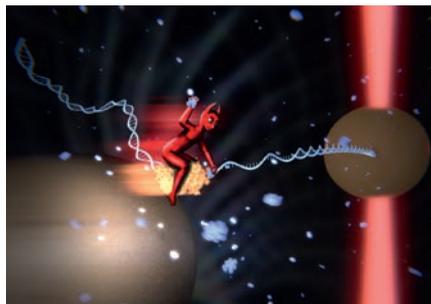
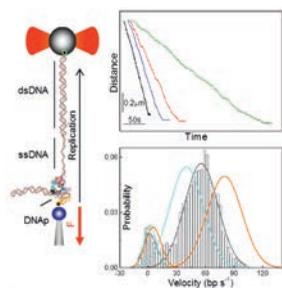
1. Single molecule characterization of the dynamic and mechanistic principles governing the operation of molecular motors involved in DNA replication and repair reactions. (EMBO J 2009, PNAS 2012, Cell Cycle 2012, Nuc. Acid Res. 2015, JSAT 2016)
2. Molecular Machinery. We are working to understand the dynamical and mechanistic processes behind the coordinated action of the molecular motors responsible for: A) the replication of the human mitochondrial genome and B) the membrane fission reaction.
3. Synthetic molecular motors. This research line aims to characterize at the single molecule level the mechanistic principles of operation of synthetic or hybrid molecular motors under physiological conditions.
4. Technological developments in single molecule manipulation. We are working to improve the resolution of the optical tweezers technique and to combine optical manipulation with fluorescence detection and temperature control systems. This exciting marriage of techniques will open up a wealth of new promising applications.

Fernando Cerrón

Ph.D. student

Katerina Lemishko

Ph.D. student





Super Resolution Fluorescence/AFM Microscopy

Dr. Cristina Flors

Researcher

PhD: Institut Químic de Sarrià, Spain

Previous Position: University of Edinburgh, Edinburgh, UK

Group webpage: <http://imdeananotools.wix.com/flors>



Dr. Alberto R. Pulido

Postdoc

Groningen University, The Netherlands

Patricia Bondía

Ph.D. student

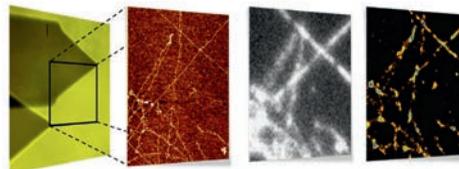


Following her degree in Chemistry, **Cristina Flors** completed her PhD at the Institut Químic de Sarrià in Barcelona in 2004 under the supervision of Prof. Santi Nonell. During that time, she studied the photophysical properties of phenalenone derivatives, with particular emphasis on their singlet oxygen photosensitization. In 2005 she moved to the laboratory of Prof. Johan Hofkens at KU Leuven, Belgium, to learn single-molecule and super-resolution fluorescence microscopy. Her most representative result from that period was the single-molecule characterization of the photoswitching properties of the fluorescent protein Dronpa and its mutants. Importantly, they showed how the thorough understanding of photophysics can help optimize super-resolution imaging. Having gained expertise in a new technique with great potential, she moved to the University of Edinburgh in 2008 to begin her independent research career, funded by EPSRC and The Royal Society. 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 Group Leader (Ramón y Cajal fellowship), where she continues to work the improvement of super-resolution fluorescence microscopy, and its application to study biology and materials. She is also interested in development and characterization of the novel fluorescent proteins for advanced microscopy applications.

Research Lines

We develop novel methods, typically based on light, to study biological problems at the nanoscale:

1. Novel methods for super-resolution imaging: super-resolution fluorescence microscopy techniques are able to image (biological) structures with a spatial resolution of tens of nm, one order of magnitude better than standard fluorescence microscopy. We develop novel methods that extend the application of super-resolution microscopy. A few years ago we were able to image for the first time directly-labelled DNA with a spatial resolution below 40 nm (*ChemPhysChem* **2009**, 10, 2201; *J. Microscopy* **2013**, 251, 1). More recently, we have implemented a novel microscope that allows us to correlate *in situ* super-resolution fluorescence imaging and atomic force microscopy (*ChemPhysChem* **2014**, 15, 647).
2. Photosensitizing fluorescent proteins for advanced microscopy: this project aims at developing improved light-responsive proteins capable of generating singlet oxygen, a particular form of reactive oxygen species that plays a crucial role in cell signalling and phototherapeutic applications. The possibility to have precise genetic control of the protein localization and thus the site of singlet oxygen generation is attracting much interest given its strong potential for applications in microscopy, optogenetics and photodynamic therapy (*JACS* **2013**, 135, 9564).





Protein Engineering

Dr. Begoña Sot

Researcher

PhD.: Universidad del País Vasco, Spain

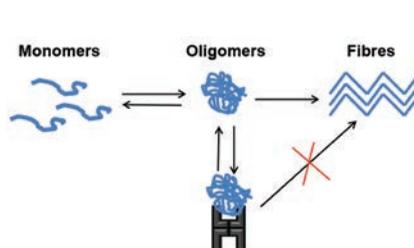
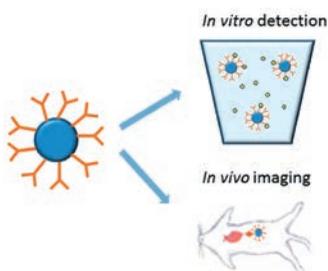
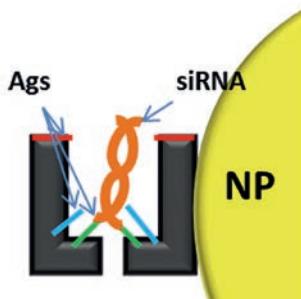
Previous Position: Centro Nacional Biotecnología (CNBCSIC), Madrid, Spain

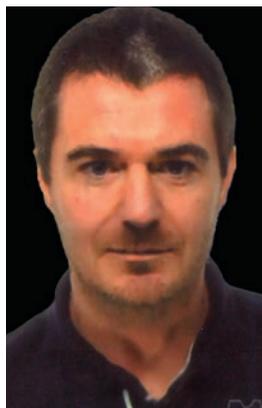
Begoña Sot did her PhD in Universidad del País Vasco, under the supervision of Prof. Arturo Muga, focused on the allostery of chaperons. Then she worked with Prof. Alan Fersht (Centre for Protein Engineering, Cambridge) gaining knowledge in biophysical characterization of protein-protein interactions. 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

The group has varied interests in proteins and their use as tools in nanomedicine:

1. Design of new immunotherapy tools based in engineered molecular chaperones and gold nanoparticles able to load Antigen Presenting Cells with antigens and siRNAs for their use in immunotherapy.
2. Biofunctionalization of magnetic and optic nanoparticles for targeting and detection of molecular markers in cardiovascular diseases.
3. Mechanism of molecular chaperones inhibition of amyloid fibers assembly.





Mechanical properties of Biostructures

Dr. Johann Mertens

Researcher

PhD.: University of Burgundy, France

Previous Position: Madrid Microelectronics Institute, Spain

Researcher ID badge: I-4208-2015

Johann Mertens obtained his BSc (1999) and MSc (2000) in Physics from the University of Bordeaux (FR). He then joined the group of Prof. Eric Finot at the University of Burgundy (FR) where he obtained his PhD in 2003. Then he worked as a research engineer at the French Atomic Energy Commission (CEA) as a project leader of the nanosensors program. He joined the group of Prof. Javier Tamayo at the Madrid Microelectronics institute as I3P postdoctoral fellow in 2005, and as a Ramón y Cajal researcher in March 2009. In 2015 he joined IMDEA as researcher in the group Mechanical Properties of Biostructures.

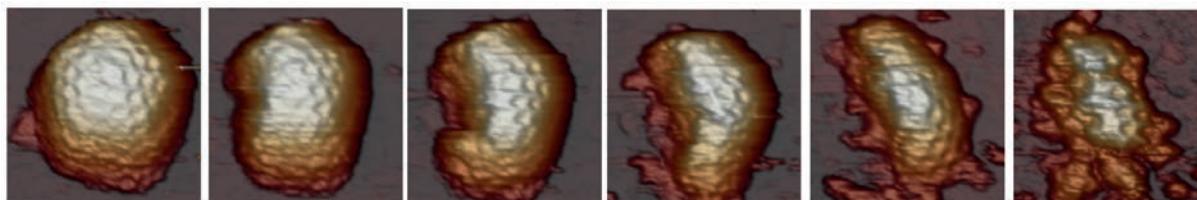
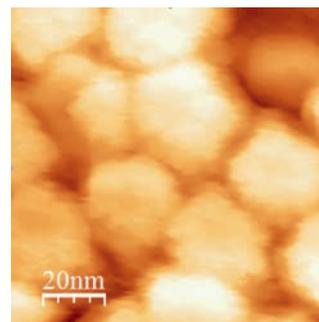
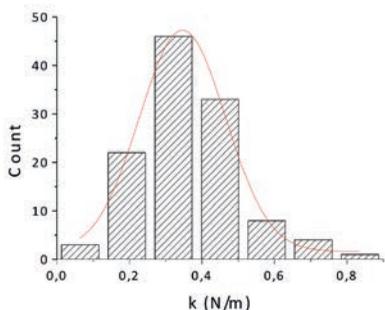
The group has varied interests in the mechanical properties of macromolecular assembly of proteins.

Dr. Javier Chichón

Postdoc

CNB-CSIC, Spain

1. We have implemented Atomic Force Microscopy (AFM) measurements in physiological conditions to study both structural and mechanical properties of individual viral particles. We have recently showed that ribonucleoprotein complexes establish strong interactions with the inner surface of the viral shell in IBDV mature virions (Scientific Reports 2015). We are also developing news tools for the combined study of the nano-mechanical properties of biomolecules using atomic force microscopy and spectroscopy.
2. We use microcantilevers as tools in biomedical applications of biosensor technology or molecular biophysics. In relation with our previous work in the field, we are developing a line related to protein and DNA biosensors as well as the study of mechanical properties 2D-systems (Nature Nanotechnology 2008, Nanotechnology 2012).





Protein Biophysics

Prof. Víctor Muñoz

Associated Senior Scientist (Unidad de Nanobiotechnología Joint Unit: IMDEA Nanociencia-CNBCSIC)

Ph.D.: Universidad Autónoma de Madrid, Spain / EMBL-Heidelberg, Germany

Group webpage: <http://www.cnb.csic.es/index.php/en/research/research-departments/macromolecular-structures/conformational-functional-behaviour-of-proteins>

Victor Muñoz obtained his PhD in Biophysical Chemistry in 1995 in the group of L. Serrano at UAM (Madrid, Spain) and EMBL (Heidelberg, Germany). In 1996 he joined the group of William A. Eaton as postdoctoral fellow at the National Institutes of Health (Bethesda, Maryland, USA). By 2000 he became Assistant Professor at the University of Maryland where he started his independent career as PI. In 2005 he was named Tenured Associated Professor in this institution. In 2007 he came back to Madrid as Professor of Centro de Investigaciones Biológicas (CSIC). In 2009 he was named Adjunct Professor of the University of Maryland. By April 2013 he moved his group to Centro Nacional de Biotecnología and IMDEA Nanoscience (where he is Associate Researcher). He is *Ad hoc* reviewer for both scientific journals and granting agencies. Throughout his career he has been received honors and awards like Camille and Henry Dreyfus New Faculty Award (2000), Packard Fellowship for Science and Engineering (2001), Searle Scholar (2002), Marie Curie Excellence Grant (2007), EMBO Member (2009) and ERC Advanced Grant (2013).



Dr. Xiakun Chu

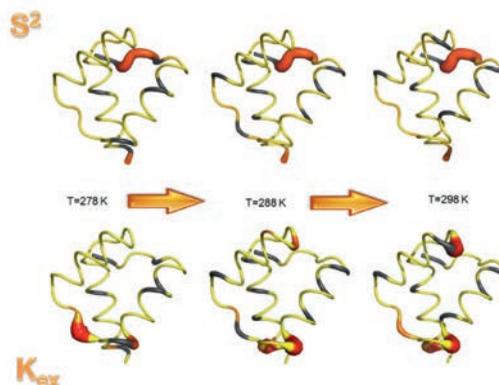
Postdoc

College of Physics, Jilin University, ChangChun, China

Research Lines

Our group investigates the conformational-functional behavior of proteins to answer questions concerning the intimate behavior of proteins using a multidisciplinary approach that combines physical chemistry, advanced molecular spectroscopy (ultrafast and single-molecule), structural biology, computer science, protein engineering, and molecular biology. Our efforts during last years have centered on three major areas:

1. Experimental and theoretical analysis of protein folding ensembles, where we have developed a catalogue of folding archetypes corresponding to small single-domain proteins with elementary combinations of secondary structure elements.
2. Investigation of the molecular rheostat hypothesis, proteins able to produce analogue signals at the single-molecule level rather than the binary outputs of conventional molecular switches. These rheostats could offer a new variety of nanobiotechnological applications. In parallel, we analyze the biological roles of conformational rheostats in coordinating protein networks via conformational selection, in the phenomenon of DNA sliding and homing-to-target, and as molecular springs in macromolecular assemblies.
3. Engineering of macromolecular assemblies, where we are engineering macromolecular devices from monomeric globular proteins. This effort borrows ideas from molecular evolution to implement a design strategy that would facilitate domain swapping between otherwise monomeric proteins by engineering their folding behavior reducing their intrinsic folding cooperativity.





Nuclear Magnetic Resonance for Biological Systems

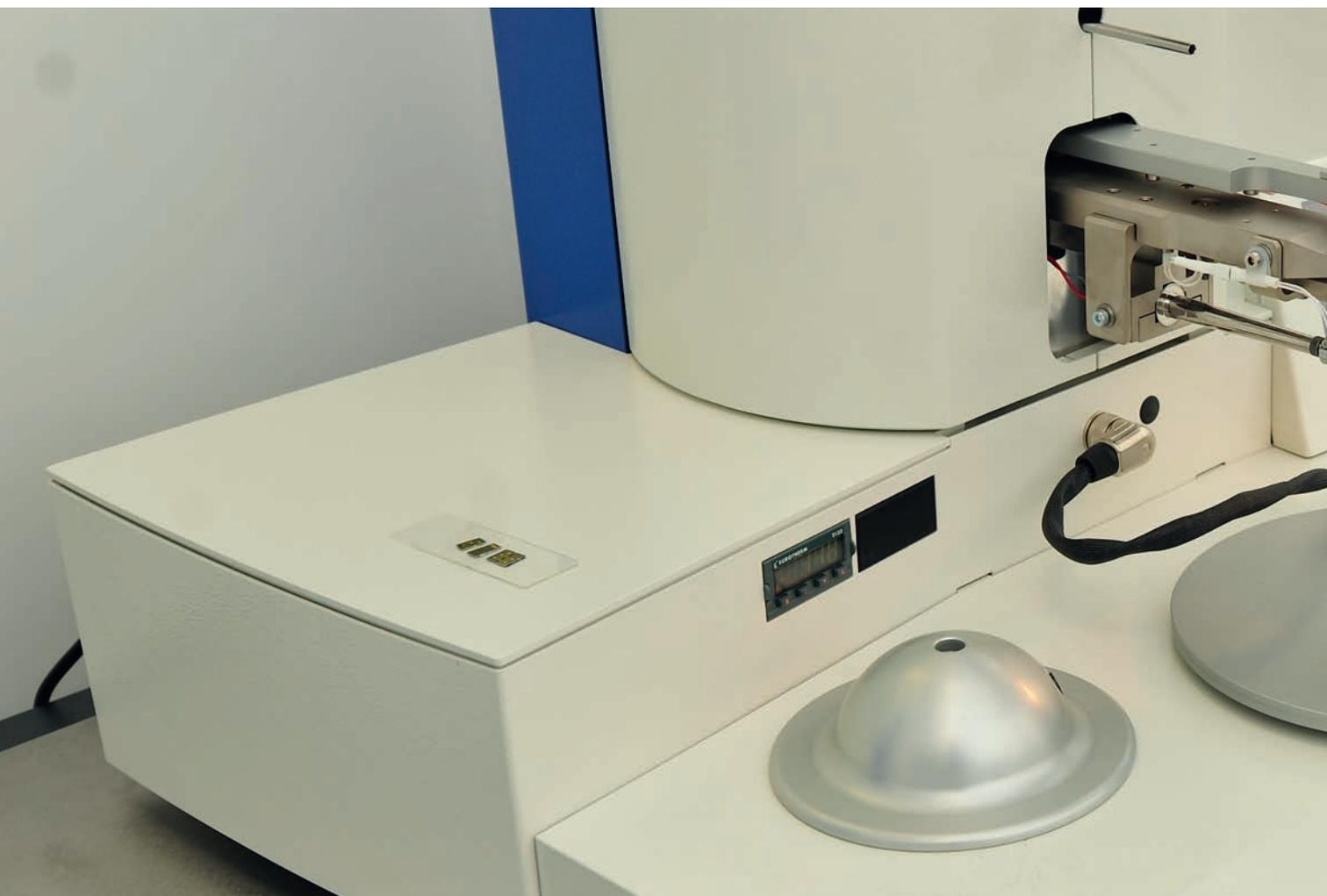
Dr. Nicola d'Amelio

Researcher

Ph.D.: University of Perugia, Italy

Previous Position: University College London, UK

My research has been directed towards the study of biological systems mainly using Nuclear Magnetic Resonance. During my PhD research (Universities of Perugia and Utrecht), I worked on the structure and the dynamics of biomolecules with a particular focus on bio-inorganic chemistry. During my post-doc (CERM of Florence) I used paramagnetic relaxation as a tool for structural constraints. This knowledge was transferred to medical applications during my stay industry (Bracco imaging), National Oncological Spanish Center for Cancer Research (CNIO, Centro Nacional Investigaciones Oncologicas), and UCL, where I focused my research on the dynamics of oncoproteins. At present, I am researcher in the group of Prof. Munoz (National Center of Biotchnology (CNB) and Instituto Madrilenio de Estudios Avanzados en Nanociencia (IMDEA-Nanociencia).



program

nanostructured functional surfaces

Program Manager: Dr. Isabel Rodriguez

Functional Surfaces

Dr. Isabel Rodríguez





Functional Surfaces

Dr. Isabel Rodríguez

Senior Researcher

PhD: National University of Singapore

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

Researcher ID: G-3178-2016

Isabel Rodríguez graduated in Pharmacy from the University of Alcalá de Henares and received a Science PhD from the National University of Singapore (1999). After graduation, she worked at the Institute of Materials Research and Engineering (IMRE), A*STAR, Singapore where she became Senior Research Scientist (2008) and later Head of IMRE's Patterning and Fabrication Group (2012). In 2013 she joined IMDEA-Nanoscience as a Senior Researcher where she currently works in areas related to polymer micro and nano fabrication technologies, primarily nanoimprinting directed to construct functional surfaces for the control of interfacial interactions, cell adhesion, wettability and optical phenomena.

Research Lines

The group's work has applications in areas including:

1. Nano-engineered functional surfaces for medical applications, particularly in the development of antibacterial functionalities and cell culture fluidic platforms for cell biomechanical assays.
2. Multifunctional surfaces. We are developing the methodology to impart onto polymer nanocomposites additional surface properties, particularly those of super-hydrophobicity and self-cleaning based on surface nanotexturing.
3. Polymer optical devices such as polymer lasers, antireflective surfaces and optical sensors. Nanoimprinting is currently employed to enable the fabrication of organic distributed feedback laser (DFB) on plastic materials for sensing applications.

Dr. Jaime Javier Hernández

Postdoc

Estructura de la Materia-CSIC, Spain

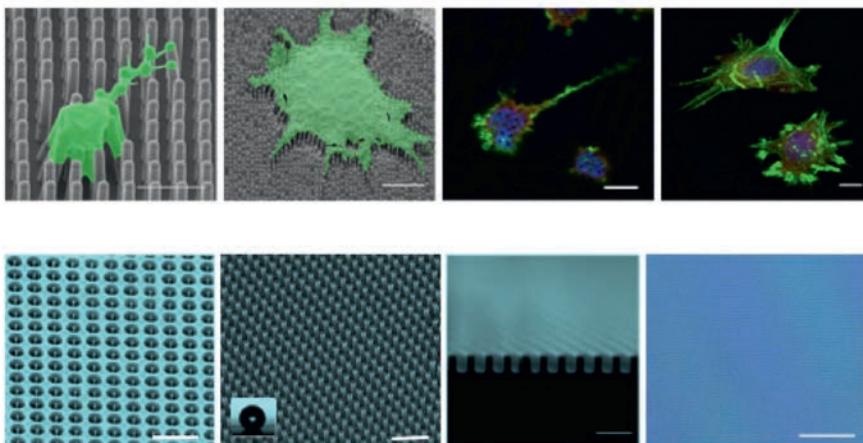
Dr. Iván Navarro

Postdoc

University of Perugia, Italy

Felipe Viela

Ph.D. student



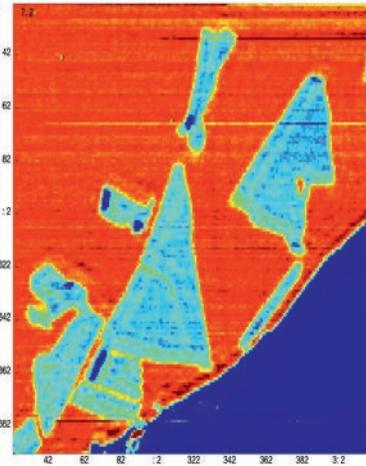
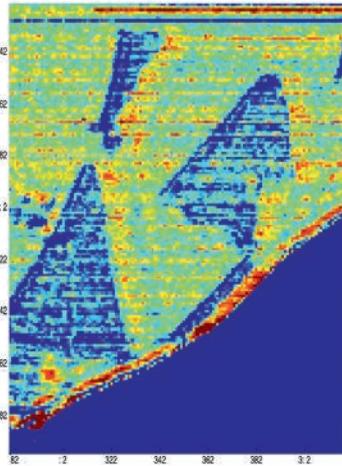
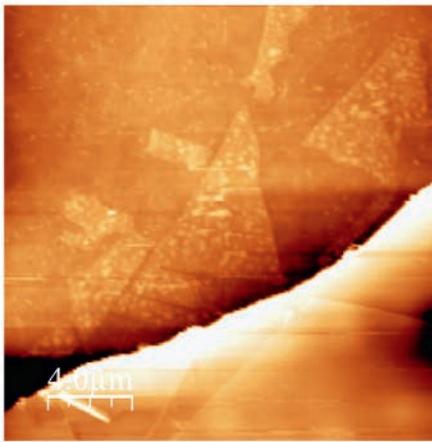
program

quantum nanodevices

Program Manager: Dr. Daniel Granados

Quantum Devices and Photonics
Dr. Daniel Granados

Superconducting Detectors





Quantum Devices and Photonics

Dr. Daniel Granados

Senior Researcher

Ph.D.: Universidad Autónoma de Madrid, Spain

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

Researcher ID: A-4090-2011

Daniel Granados obtained his BSc (2001) and MSc (2002) in Physics from the Universidad Autónoma de Madrid (Spain). He then joined the Molecular Beam Epitaxy group at the Instituto de Microelectrónica de Madrid-CSIC (Spain), where he obtained his PhD in 2006 under the supervision of Prof. J.M. García. In 2005 he was visiting scientist at the Nano-Optics group of Prof. Richard J. Warburton at Heriot-Watt University, Edinburgh (UK). He then joined (2006) the Quantum Information Group of Prof. Andrew J. Shields at Toshiba Research Europe Ltd, Cambridge (UK) as research scientist. During this time he was also visiting scientist and collaborator of the Semiconductor Physics Group, headed by Prof. David Ritchie, at the Cavendish Laboratory, Cambridge (UK).

In September 2009 he joined IMDEA Nanoscience as tenure-track scientist and as main supervisor of the construction and start-up of the Centre of Nanofabrication. In 2014 he obtained a Ramón y Cajal fellowship and was tenured and promoted to Senior Researcher and Director of the Centre of Nanofabrication. Since December 2015 he is also Executive Director of Scientific Infrastructure.

Ramón Bernardo

Ph.D. student

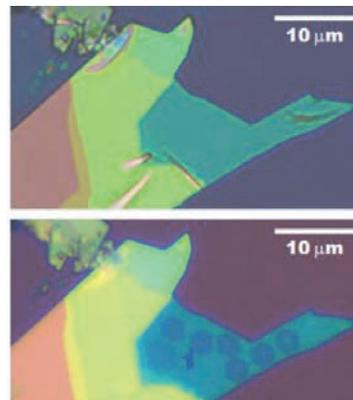
Fernando Jiménez

Technician

Research Lines

The group has varied interests in nano-photonics, near-field microscopy & spectroscopy and quantum devices.

1. Novel photonic crystals and quantum dots: We are exploring new ways of fabricating photonic cavities and quantum dots directly onto two dimensional materials such as transition metal dichalcogenides. (to be submitted).
2. Near-Field spectroscopy: We have developed a SNOM coupled and synchronised with an optical spectrometer+CCD, which allows us to acquire simultaneously topography and spectrally resolved photon maps either in reflection or transmission modes. We are studying periodic plasmonic devices and nano-electro-mechanical optical systems. We can also study the near-field response of quantum devices under test, such as GFETs or MoS₂ FETs.



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.

Center for Nanofabrication



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

Dr. David Pérez de Lara joined IMDEA Nanoscience in January 2010. Graduated in Theoretical Physics at UAM (1994), David Perez 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). 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 Santiago de Compostela, Spain

Fernando Jiménez

Technician



RMN and Mass Spec.Services



Dr. Javier López Ogalla

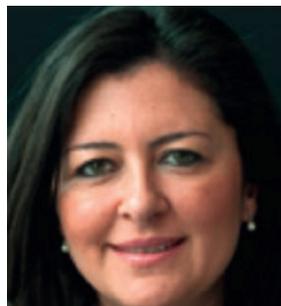
Ph. D. Universidad Autónoma de Madrid, Spain

Optical Tweezers



Dr. Rebeca Bocanegra

Ph. D. Universidad Autónoma de Madrid, Spain



Sara de Lorenzo

Ph. D. Universidad de Barcelona, Spain

Workshop



Warren Smith

Technician

AFM Service



Dr. Santiago Casado

Ph. D. Universidad de Cantabria, Spain

Cell Cultures



Dr. Adriana Arnaiz

Ph. D. University of Cambridge, UK



Dr. Vanessa Rodríguez

Ph. D. Universidad Autónoma de Madrid, Spain

Functionalizacion of Nanoparticles



Dr. Antonio Aires

Ph. D. Universidad Autónoma de Madrid, Spain

Nanofabrication Services



Dr. Manuel Rodríguez

Ph. D. Universidad de Santiago, Spain

research staff

management



D. Bonifacio Vega
General Manager
(since October 2015)



Dª Isabel Rodríguez
MS in Administration,
Administration and Finance
Manager



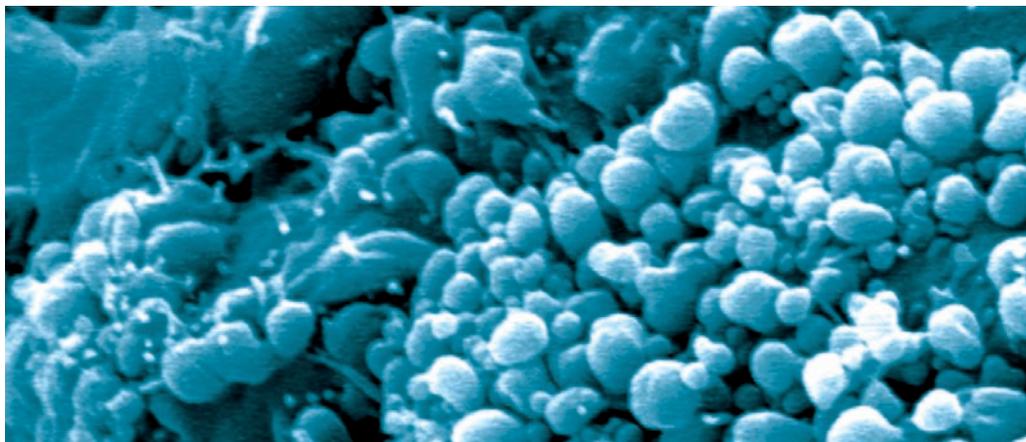
Dr. María Jesús Villa
Projects, Institutional
Relations and HR Manager



Dr. José Luis Casillas
Facilities & Infrastructure
General Manager



Dª Patricia López
Project Assistant





Dr. David Sayago
POCAONTAS Project Manager



Dª Paloma Macua
Administrative Assistant



Óscar Bodas
Network and Systems
Manager



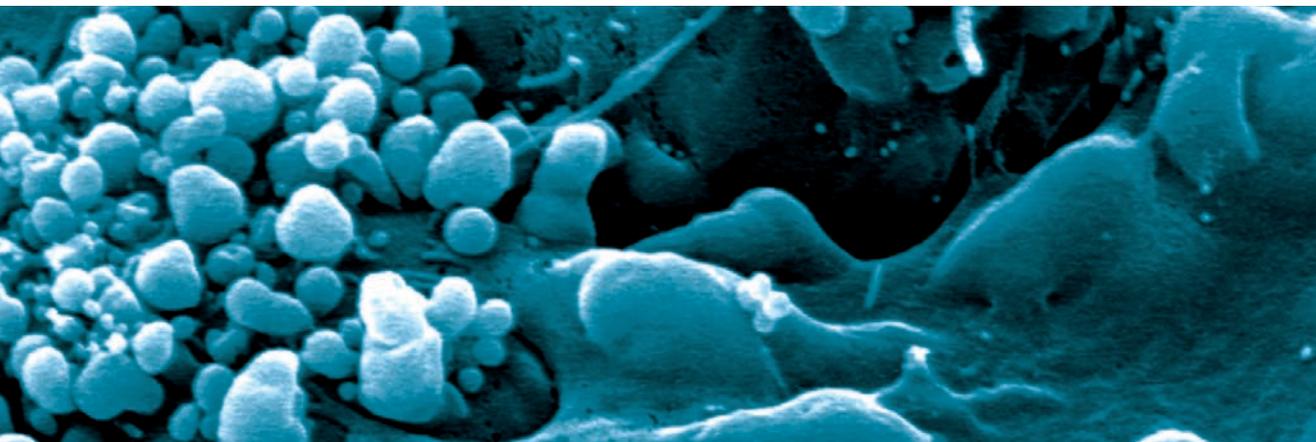
Dr. Mark William Davies
Transfer and Business
Development Assistant



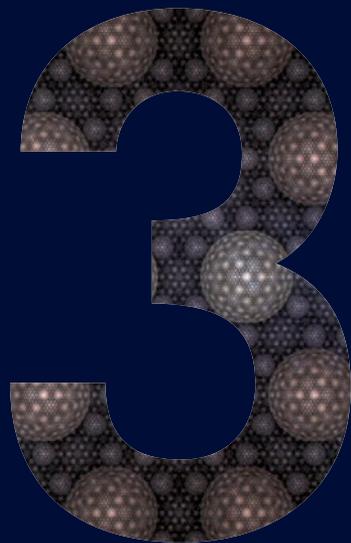
Dª Elena Pérez
Administrative Assistant



Dª Juana Hemoso
Administrative Project
Assistant



scientific report



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annual report
2015

3.1. Publications, contributions to books and patents

3.1.1. Publications

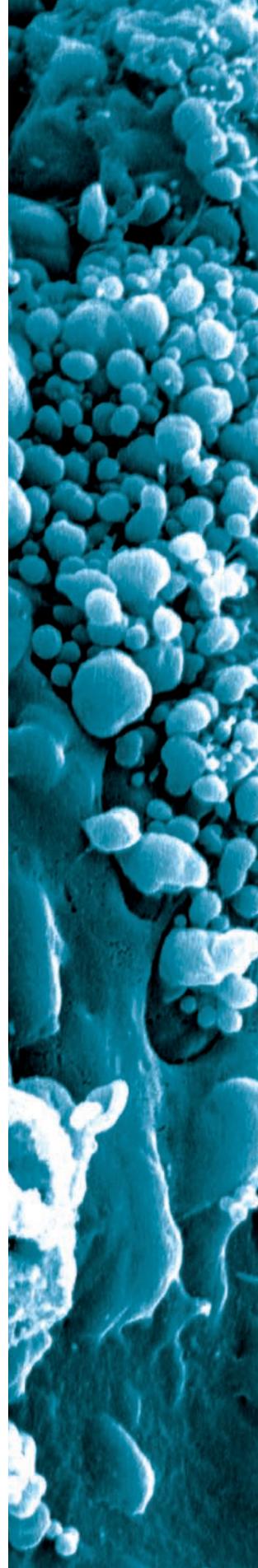
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- 6. Diamond nanoparticles based biosensors for efficient glucose and lactate determination.** Briones, M., Casero, E., Petit-Domínguez, M. D., Ruiz, M. A., Parra-Alfambra, A. M., Pariente, F., Lorenzo, E., & Vázquez, L. *Biosens Bioelectron*, 2015, **68** 521-528. doi:10.1016/j.bios.2015.01.044
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- 8. Dual functional graphene derivative-based electrochemical platforms for detection of the TP53 gene with single nucleotide polymorphism selectivity in biological samples.** Esteban-Fernández De Ávila, B., Araque, E., Campuzano, S., Pedrero, M., Dalkiran, B., Barderas, R., Villalonga, R., Kiliç, E., & Pingarrón, J. M. *Anal. Chem.*, **87**(4) 2290-2298. doi:10.1021/ac504032d
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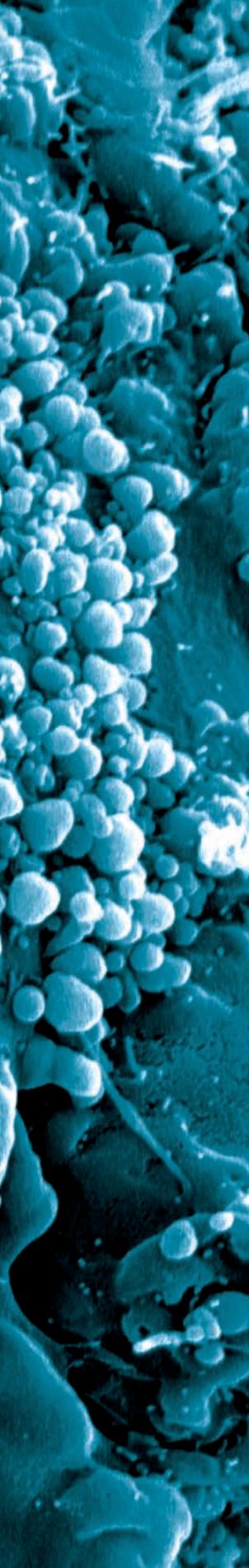
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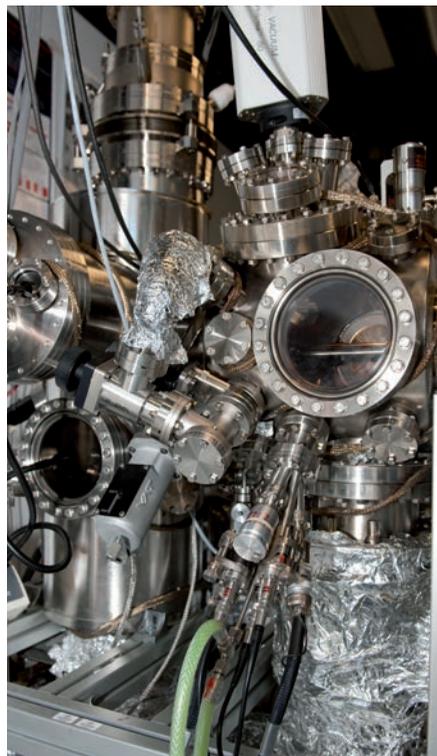
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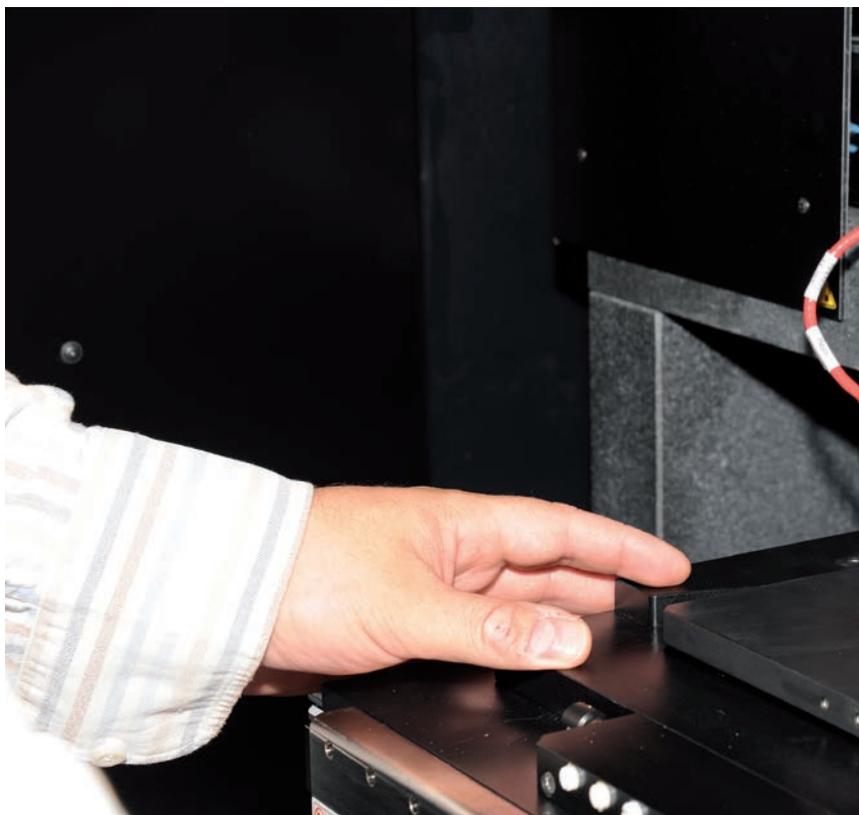


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175. Band structure of topological insulators from noise measurements in tunnel junctions Juan Pedro Cascales, Isidoro Martínez, Ferhat Katmis, Cui-Zu Chang, Rubén Guerrero, Jaga-

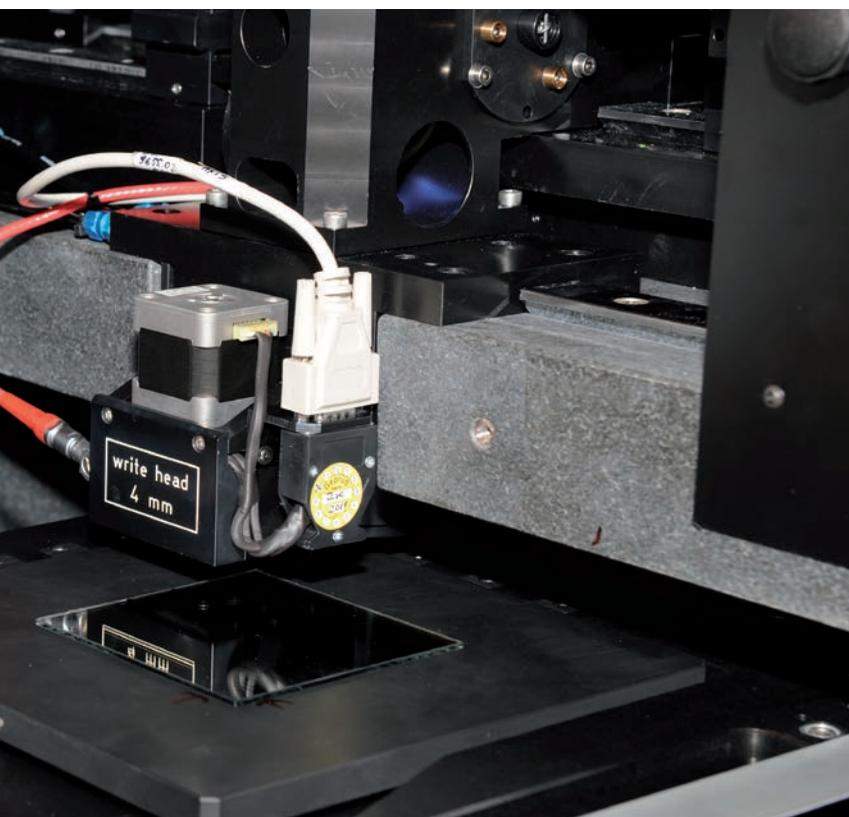
deesh S. Moodera and Farkhad G. Aliev *Appl. Phys. Lett.*, **107**, 252402 (2015). <http://dx.doi.org/10.1063/1.4938243>

176. Quaternized Pyridyloxy Phthalocyanines Render Aqueous Electron-Donor Carbon Nanotubes as Unprecedented Supramolecular Materials for Energy Conversion Anaya-Plaza, Eduardo, Oliva, Maria Moreno, Kunzmann, Andreas, Romero-Nieto, Carlos, Costa, Ruben D., de la Escosura, Andres, Guldi, Dirk M., Torres, Tomas *Adv. Funct. Mater.* 2015, **25**, 7418–7427 doi: [10.1002/adfm.201503002](https://doi.org/10.1002/adfm.201503002)

177. Ground State Host-Guest Interactions upon Effective Dispersion of Regioregular Poly(3-hexylthiophene) in Poly(9,9-dioctylfluorene-alt-benzothiadiazole) Longfei Wu, Santiago Casado, Beatriz Romero, Jose Manuel Otón, Jorge Morgado, Christian Müller, Ruidong Xia, and Juan Cabanillas-González *Macromolecules*, 2015, **48**, pp 8765–8772 doi: [10.1021/acs.macromol.5b02111](https://doi.org/10.1021/acs.macromol.5b02111)

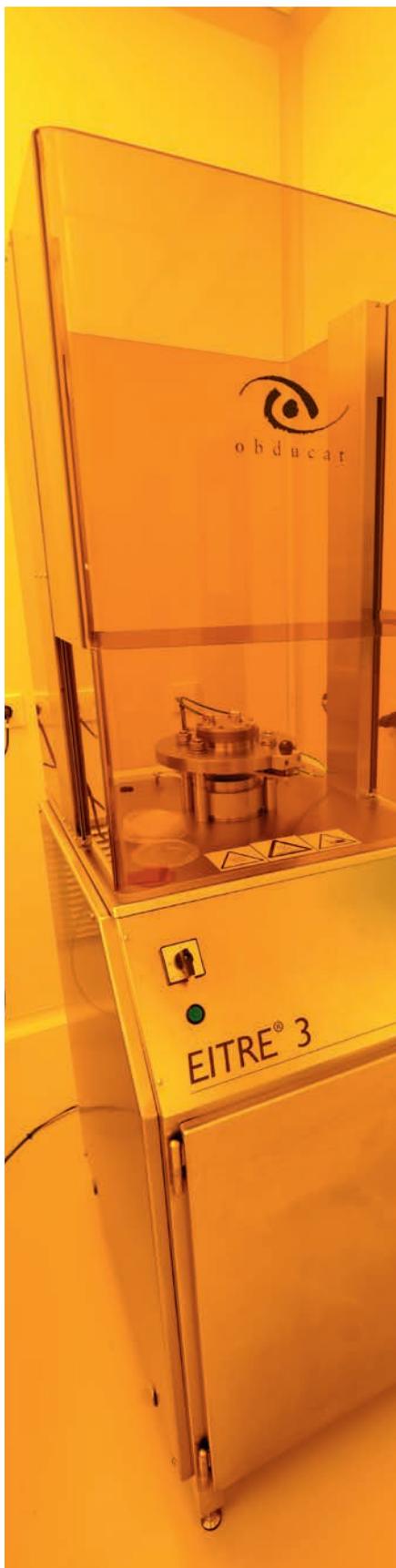
178. Theoretical methods for attosecond electron and nuclear dynamics: applications to the H₂ molecule Palacios, Alicia; Sanz-Vicario, José Luis; Martín, Fernando *2015 J. Phys. B: At. Mol. Opt. Phys.*, **48**, 242001. DOI: [10.1088/0953-4075/48/24/242001](https://doi.org/10.1088/0953-4075/48/24/242001)

179. Mapping the Dissociative Ionization Dynamics of Molecular Nitrogen with Attosecond Time Resolution A. Trabattini, M. Klinker, J. González-Vázquez, C. Liu, G. Sansone, R. Linguerrri, M. Hochlaf, J. Klei, M.J.J. Vrakking, F. Martín, M. Nisoli, and F. Calegari *Phys. Rev. X* **5**, 04105 (2015) DOI: [10.1103/PhysRevX.5.041053](https://doi.org/10.1103/PhysRevX.5.041053)



3.1.2. Contributions to books

1. "Biomedical Applications of Magnetic Nanoparticles" D. Ortega in *Encyclopedia of Inorganic and Bioinorganic Chemistry*, ed. R.A. Scott, John Wiley: Chichester. (DOI: 10.1002/9781119951438.eibc0315.pub2
2. "Chapter 9. Newest approaches to singlet oxygen photosensitisation in biological media" Oriol Planas, Ester Boix-Garriga, Beatriz Rodríguez-Amigo, Joaquim Torra, Roger Bresolí-Obach, Cristina Flors, Cristiano Viapiani, Montserrat Agut, Rubén Ruiz-González and Santi Nonell in *Photochemistry: Volume 42*, 233. Editor(s): Elisa Fasani, Angelo Albini. Royal Society of Chemistry. 2015. doi:10.1039/9781782624547-002333.
3. "Atomic-scale friction measurements in ultra-high vacuum" Maier, S., Gnecco, E., Meyer, E. in *Fundamentals of Friction and Wear on the Nanoscale*. Gnecco, Enrico, Meyer, Ernst. Springer International Publishing. 2015. pp. 95-114. doi:10.1007/978-3-319-10560-4_6
4. "Friction and Wear of Mineral Surfaces in Liquid Environments" Pina. C.M., Pimentel C., Gnecco, E. in *Fundamentals of Friction and Wear on the Nanoscale*. Gnecco, Enrico, Meyer, Ernst. Springer International Publishing. 2015. pp.157-173. doi:10.1007/978-3-319-10560-4_6

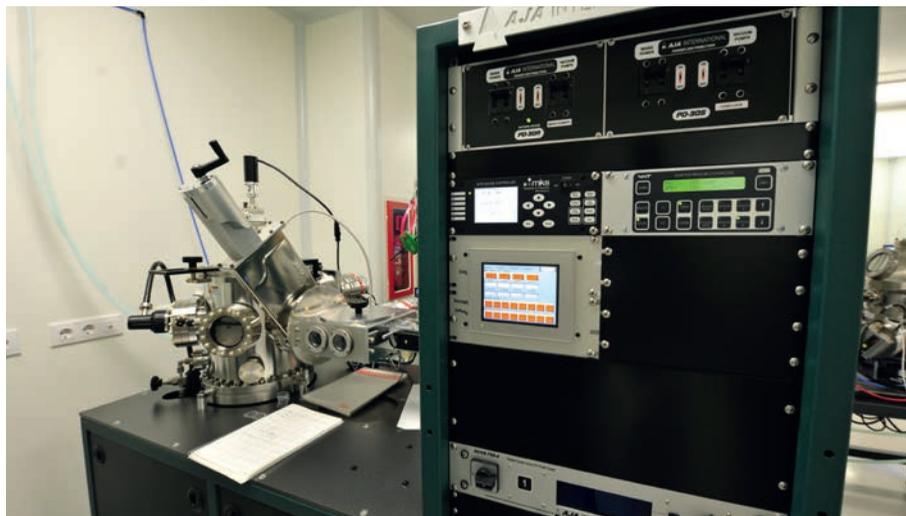


contributions to books

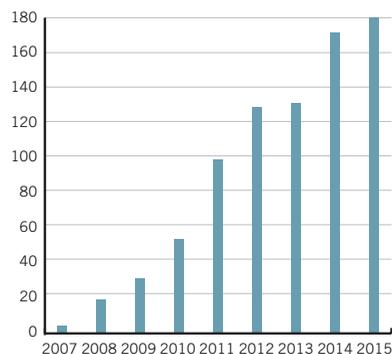
3.1.3. Patents

1. **position Sensitive Photodetector:** Spanish Patent Office (FULLY REGISTRED) – PCT Extended to Europe, USA, and Japan; 50% ownership with CSIC.
2. **Solid Support for Oligonucleotide Synthesis:** European Patent Office (FULLY REGISTRED) – PCT Extension; 100% IMDEA.
3. **New Method for the Synthesis of Graphene Inks:** European Patent Office; IMDEA 25%, UAM 25%, Abengoa Research 50%. Pre-Commercial Agreement with Abengoa Research.
4. **COF Covalent Organic Frameworks:** European Patent Office; IMDEA 50%, UAM 40%, UCM 10%.
5. **Preparation of Corrugated and Porous Graphene using COFs for its use as Supercapacitors:** Spanish Patent Office; UVEG 70%, UAM 17.5%, IMDEA 12.5%
6. **Single-Point Mutation Detection in RNA Extracts using Gold Nanoparticles Modified with Hydrophobic Molecular Beacons:** European Patent Office; 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.
8. **Covalent Modified Graphene:** Spanish Patent Office;
9. **Functionalised Magnetic Nanoparticles:** Spanish Patent Office;

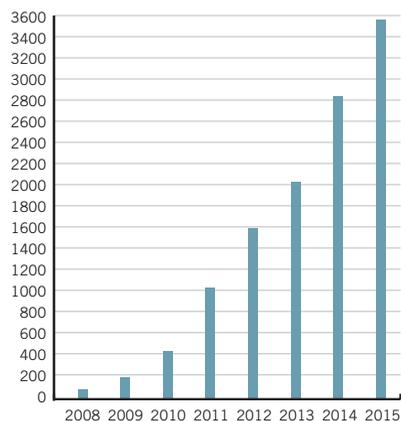
patents



Publications in each year



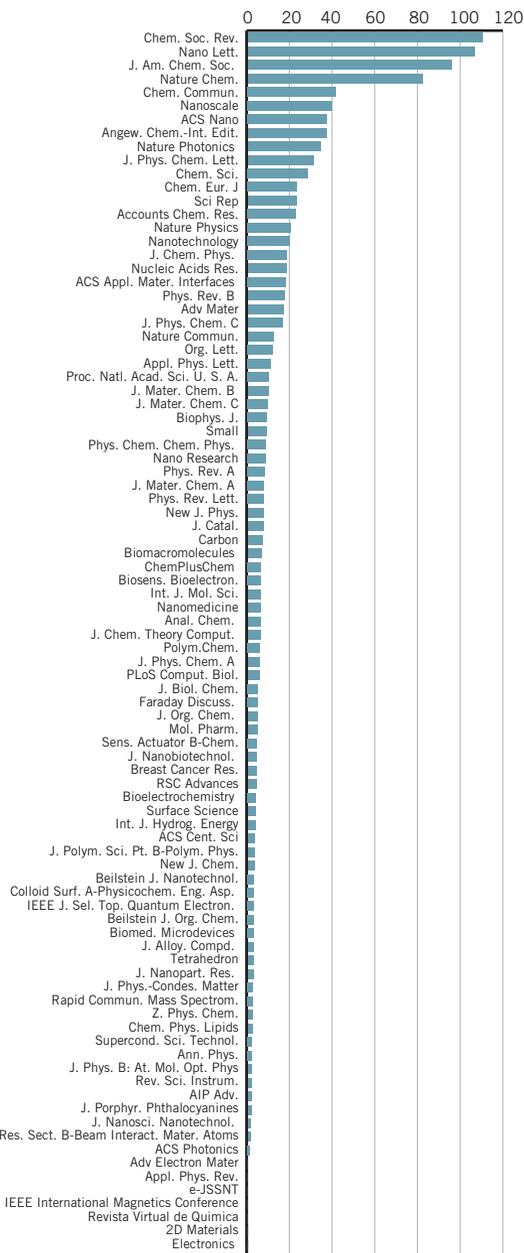
Citations in each year



- **Sum of the times cited: 13,220**
- **Sum of Times Cited without self-citations: 11,219**
- **Average citation per item: 15,37**
- **h index: 53**
- **Papers: 179**

Impact factor of the publications in 2015

Total indexed publications: 179
Average impact factor: 6,821



impact of the publications

3.2. International Congresses: Invited Lectures and Regular Contributions

3.2.1. Invited lectures

10-13.03.2015

NanoSpain "Chemistry" International Conference, Imaginenano 2015, Bilbao, Spain

Phthalocyanines and related systems as components of photovoltaic and artificial photosynthetic systems

T. Torres

2D Materials based on Covalent Organic Frameworks

F. Zamora

30.03-01.04.2015

Repetitive non-globular proteins: Nature to nanotechnology, York, UK

Biomolecular templating of functional hybrid nanostructures using repeat protein scaffolds

Aitziber L. Cortajarena

25-28.04.2015

5th Bionanomaterials Conference, Algarve, Portugal

Protein-based functional nanostructured biomaterials

Aitziber L. Cortajarena

06-07.05.2015

Applied Optics and Photonics China, 2015, Beijing, China

Manipulation of nucleic acids and nanoparticles with optical tweezers at the single specimen level

J.R. Arias-Gonzalez

09-11.05.2015

International Symposium on Advanced Permanent Magnetic Materials, Beijing, China

Ferrites-based permanent magnets for technological applications

A. Bollero

10.05.2015

EU-Korea Workshop, E-MRS Meeting, Lille, France

Organic Single Crystal Lasers by Targeted Design

J. Gierschner

11-13.05.2015

Workshop on Energetic Processing of Large Interstellar Molecules, Leiden, the Netherlands

Dynamics of coalescence reactions of fullerenes and polycyclic aromatic hydrocarbons induced by ion collisions

Wang, Yang

international congresses

11-15.05.2015

E-MRS Meeting, Lille, France

Nanomagnetism' strategies for bio-sensors and nanomedicine

P. Perna

Design of magnetic nanoparticles for biomedical applications

G. Salas

Nanoparticle functionalization for selective treatment of cancer cells

Aitziber L. Cortajarena

19.05.2015

Symposium on 2D materials OMNT (Observatory of Micro- and Nano- technologies), Paris, France

2D Optomechanics

A. Castellanos-Gomez

24-28.05.2015

227th Meeting of the Electrochemical Society (ECS), Chicago, United States of America

Subphthalocyanines: Supramolecular Organization and Self-Assembling Properties

T. Torres

Hydrogen-bonding and π -stacking induced self-assembly of picolinic acid-substituted phthalocyanine derivatives

G. Bottari

17.06.2015

Workshop on 2D Materials, Alicante, Spain

Atomically thin optoelectronics: 2D semiconductors beyond graphene

A. Castellanos-Gomez

22-26.06.2015

The International Conference on Understanding and Controlling Nano and Mesoscale Friction, Istanbul, Turkey

The Prandtl-Tomlinson model: Variations on a theme

E. Gnecco

28.06-03.07.2015

27th International Conference in Photochemistry, Jeju, South Korea

Photochemical tools for correlative microscopy

C. Flors

29.06-02.07.2015

19th International Conference on Electron Dynamics in Semiconductors, Optoelectronics and Nanostructures - EDISON'19, Salamanca, Spain

Tailoring graphene for spintronics

R. Miranda

01-04.07.2015

Energy Materials Nanotechnology, Istanbul, Turkey

Introducing a giant spin-orbit effect on epitaxial graphene by Pb intercalation

A.L. Vázquez de Parga

05-10.07.2015

16th International Symposium on Novel Aromatic Compounds (ISNA-16)

Subphthalocyanines: Singular aromatic non-planar molecules

T. Torres

Adding Magnetic Functionalities to Epitaxial Graphene

R. Miranda

Giving Nanotubes a Ring. Mechanically Interlocked Derivatives of SWNTs

E. M. Pérez

05-10.07.2015

XX International Conference on Magnetism, Barcelona, Spain

Adding magnetic functionalities to epitaxial graphene

R. Miranda

Vortices and antivortices on the move: A powerful tool to probe magnetic states in nanomagnets

J. L. Vicent





07-10.07.2015

VII Workshop on Analytical Nanoscience and Nanotechnology, Salamanca (Spain)

Biosensor Platforms Based on Ga Nanoparticle Arrays

E. Lorenzo

08-10.07.2015

Biotech Annual Congress 2015, Salamanca, Spain

Protein engineering: From Nature to Nanotechnology

Aitziber L. Cortajarena

19-17.07.2015

Interaction effects in graphene and related materials, San Sebastian, Spain

Adding magnetic functionalities to graphene

A.L. Vázquez de Parga

Atomically thin optoelectronics: 2D semiconductors beyond graphene

A. Castellanos-Gomez

19-23.07.2015

XXXV Reunión Bienal de la RSEQ, A Coruña, Spain

Phthalocyanines: old dyes, new molecular materials

T. Torres

20-24.07.2015

Quantum Transport in Nanoscale Molecular Systems, Telluride, Colorado, USA

Thermopower Control in Molecular Junctions

N. Agrait

23-25.07.2015

Physical properties of nanoparticles: Characterization and applications. DPG, Bad Honnef, Germany

Synthesis of nanoparticles

Beatriz H. Juárez

26-31.07.2015

EMRS, Warsaw, Poland

Synthesis and optical trapping of alloyed semiconductor nanocrystals encapsulated in SiO₂ shells

Beatriz H. Juárez

03-05.08.2015

5th Molecular Materials Meeting M3.Singapur

Designing 2D-Materials

F. Zamora

26-28.08.2015

Single Molecule Localization Microscopy Symposium, Bordeaux, France

Super-resolution and atomic force microscopy: a powerful combination

C. Flors

01-04.09.2015

Summer School on "Computation of Excited States", Donostia - San Sebastián, Spain

Excited States in Conjugated Polymers

J. Gierschner

14-18.09.2015

5th International Seminar of Nanoscience and Nanotechnology, La Havana, Cuba

Nanoparticulas magnéticas aplicadas a la Medicina

R. Miranda

21-22.09.2015

NANODEM Workshop on Fluorescence for Biosensing, Madrid, Spain

Super-resolution fluorescence microscopy

C. Flors

20-26.09.2015

Second International Fall School on Organic Electronics, IFSOE, Moscow, Russia

Photophysics in Luminescent Single Crystals for Organic Optoelectronics

J. Gierschner

23-25.09.2015

6th European Nanomanipulation Workshop, Giesen, Germany

Surface rippling as a nanomanipulation process: A novel interpretation and ways to prevent it

E. Gnecco

24-26.09.2015

The 5th Annual World Congress of Nano Science & Technology-2015, Xi'an, China

Magnetoplasmonic properties of Au/Co/Au nano-ring based structures by hole mask colloidal lithography

Feng Luo

06-08.10.2015

1st NGP-NET Symposium on Non-globular Proteins, Porto, Portugal

Repeat proteins as scaffolds for nanotechnology

Aitziber L. Cortajarena

13-16.10.2015

Quimi-Cuba 2015, La Havana, Cuba

Synthesis and optical trapping of alloyed semiconductor nanocrystals encapsulated in SiO₂ shells

Beatriz H. Juárez

20-24.10.2015

8th European School on Molecular Nanoscience, Paris, France

Thermoelectricity in Single-Molecule Junctions

N. Agrait

25.10.2015

5th Trilateral EU-US-Japan Conference on Critical Materials, Tokio, Japan

Hybrid ferrites for permanent magnet applications: from processing to industrial recycling and proven functionality

A. Bollero

09-12.11.2015

EMN Meeting on DNA and RNA, Istanbul, Turkey

Oligonucleotides and Nanostructures for Biomedical Applications

Álvaro Somoza

29.11-04.12.2015

2015 MRS Fall Meeting, Boston, Massachusetts Boston, USA

Rare Earth-Free Magnetic Powders for Permanent Magnet Applications: From Synthesis to Industrial Recycling

A. Bollero

03-04.12.2015

Workshop on 2D Materials, Valencia, Spain

Thermopower of Molecules and Thin 2d Crystals

N. Agrait

Strong modulation of optical properties in black phosphorus through strain

A. Castellanos-Gomez

A transparent electrical conductive metal-organic nanofilm with unusual behaviour found by serendipity

F. Zamora

11.12.2015

Workshop ICMM-AXA Research, ICMM-CSIC, Madrid, Spain

Magnetic Nanoparticles. For biomedical applications?

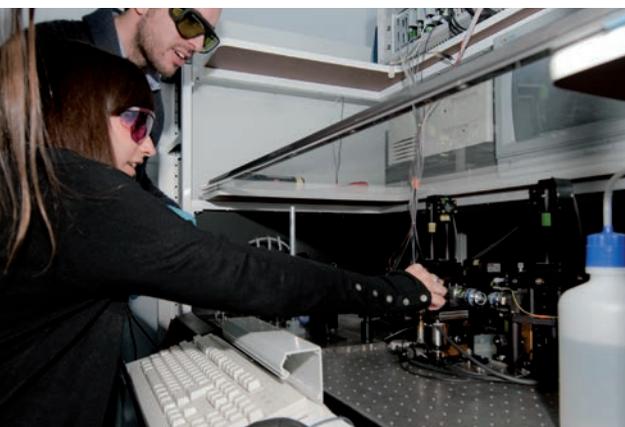
G. Salas

15-20.12.2015

PACIFICHEM 2015, Chemistry of Nanocarbons: Fullerenes, Carbon Nanotubes, Nanographenes and Related Materials, Honolulu, Hawaii, USA.

"Phthalocyanine and subphthalocyanine containing carbon nanostructures"

T. Torres



3.2.2. Regular contributions

23-25.02.2015

Final MultiFun 2015 Workshop, Madrid, Spain

Oral Contribution

Influence of nanoparticle size and field frequency on the concentration dependence of magnetic heating

D. Cabrera, G. Salas, R. Ludwig, J. Camarero, R. Miranda, I. Hilger, and F. J. Terán

Poster Contributions

Silica encapsulation of magnetic nanoparticles
L. de la Cueva, P. Rodríguez, R. Amaro, D. Cabrera, M. Acebrón, B. H. Juárez, F. J. Terán, and G. Salas

Functionalized magnetic nanoparticles for cancer therapy"

A. Aires, S. M. Ocampo, D. Cabrera, L. de la Cueva, Y. Fernández, G. Salas, F.J.Terán, and A. L. Cortajarena.

05-07.02.2015

6th Symposium on Computing pi-Conjugated Compounds (CPiC), Olomouc Czech Republic

Poster Contribution

Excited State Features and Dynamics in Conjugated Organic Materials

J. Gierschner

08-11.02.2015

SYMOLESCO Workshop, Engelberg, Switzerland

Oral Contributions

Conductance, current-voltage characteristics, and thermopower measurements for molecular junctions

M. Teresa González, Edmund Leary, Delia Miguel, Laura Rincón, Charalambos Evangelí, Ana Martín-Lasanta, Gabino Rubio-Bollinger, Nicolás Agraït

02-06.03.2015

American Physical Society March Meeting, San Antonio, Texas, USA

Oral Contributions

Memristive behavior in tunnel junctions with graphene oxide barrier

M. Rocci, A. Perez-Muñoz, F. Galvez, J. L. Vicent, Z. Sefrioui, C. Leon, J. Santamaria, F. Perrozzi, L. Ottaviano, M. Nardone, S. Santucci, E. Treossi, V. Palermo

Interplay between vortex matter phases and arrays of pinning centers in low temperature superconductors.

J. L. Vicent, J. del Valle, A. Gomez, M. Rodriguez, D. Granados, F. Galvez, E. M. Gonzalez.

08-14.03.2015

Quantum Plasmonics Workshop, Benasque, Spain

Poster Contribution

Magnetoplasmonic Structures based on nanorings for tunable magneto-optical activity in wide wavelength ranges

Hua Yu Feng, Feng Luo, Renata Kekesi, Daniel Granados, David Meneses Rodríguez, Jorge M. García, Antonio Garcia Martín, Gaspar Armelles, and Alfonso Cebollada

10-13.03.2015

ImagineNano, Bilbao, Spain

Oral Contribution

Correlative atomic force and super-resolution fluorescence microscopy: a novel tool for characterization at the nanoscale

Aitor Monserrate, Santiago Casado, Cristina Flors

06-10.04.2015

Materials Research Society, San Francisco, California, USA

Oral Contribution

Probing the magnetic vortex state by superconducting vortices

J. L. Vicent, J. del Valle, A. Gomez, E. M. Gonzalez

13-17.04.2015

Lubricated Contacts, Cádiz, Spain

Oral Contributions

Role of Microstructure on Corrosion Initiation of an Experimental Tool Alloy: A Quantitative Nanomechanical Property Mapping study

Rubén Álvarez-Asencio, Majid Sababi, Jinshan Pan, Jörgen Andersson, Mark Rutland

Control of Friction and Wear on the Nanoscale by Ultrasonic Vibrations

P. Pedraz, E. Gnecco, R. Wannemacher

26-30.04.2015

Anharmonicity in medium-sized molecules and clusters (AMOC 2015), Madrid, Spain

Poster Contributions

Molecular dynamics study of fullerene collisions
 Wang, Yang; Alcamí, Manuel ;Martín, Fernando

Fragmentation dynamics of doubly charged bio-molecules induced by photoionization

Wang, Yang; Ha, D.-T. ;Kukk, E. ;Levola, H. ;Rossich, E. ;Piekariski, D. ;Díaz-Tendero, S. ;Kooser, K. ;Itälä, E. ;Rachlew, E. ;Alcamí, Manuel ;Martín, Fernando

10-15. 05.2015

XV International workshop on vortex matter in superconductors, El Escorial

Oral Contribution

Tunable zero-field vortex ratchet in Nb thin films

J. del Valle, A. Gómez, E. M. González, M. R. Osorio, D. Granados, J. L. Vicent

11-15.05.2015

E-MRS Meeting, Lille, France

Oral Contributions

Controlled Light Emission in Distyrylbenzene-Based Single Crystals

J. Gierschner

Origin of Anisotropic Giant Magnetoresistance in magnetic nanostructures

Paolo Perna

18-22.05.2015

3rd MOLESCO Workshop, Oviedo, Spain

Oral Contribution

Thermopower in single molecular junctions with non-gold contacts

Simon Svatek, N. Agrait

Poster Contribution

Mechanically tunable thermopower of single-molecule junctions

Laura Rincón-García, C. Evangelini, N. Agrait

04-11.06.2015

European Summer School on Organic Photovoltaic Stability, Corsica, France

Oral Contribution

Simulation of Optical Field Distribution Based on CuPc/C60 Bilayer SolarCells

Guilin Liu, Juan Cabanillas-González, Miguel Angel Niño, Larry Lüer, Feng Luo

08-09.06.2015

Scientific Workshop on Biomedical, Health and Bio-Related applications of Hybrid Materials (HINT COST)

Oral Contribution

Design of magnetic nanoparticles for cancer therapy and diagnosis

Gorka Salas

10-12.06.2015

XIV Congress of the Spanish Biophysical Society (SBE 2015), Granada, Spain

Oral Contribution

Single-stranded RNA interaction with long human telomeric RNA unveiled at the single-molecule level

I. Gutiérrez, M. Garavís, S. Casado, C. González, A. Villasante and J.R. Arias-González





17-18.06.2015

5th Early Stage Researchers Workshop in Nanoscience, Madrid, Spain

Oral Contributions

Covalent patterning of graphene with periodicity at the nanometer scale

J.J. Navarro, S. Leret, F. Calleja, D. Stradi, A. Black, R. Bernardo-Gavito, M. Garnica, D. Granados, A.L. Vázquez de Parga, E.M. Pérez and R. Miranda

Challenges in Single Nanoparticle Optical Manipulation for Medicine"

H. Rodríguez Rodríguez, M. Acebrón, L. de la Cueva, D. Cabrera, S. de Lorenzo, R. Amaro, D. Ortega, Daniel Granados, G. Salas, F. J. Terán, B. H. Juárez and J. R. Arias-González

Poster Contribution

Effects of particle size and dynamical conditions on the concentration dependence of magnetic heating of IONP"

D. Cabrera, D. Ortega, G. Salas, and F. J. Terán

16-19.06.2015

VII AUSE Congress, Barcelona, Spain

Oral Contribution

X-ray circular dichroism in adsorbed films of homochiral organic molecules on ferromagnetic substrates

Miguel Angel Niño Ortiz

22-26.06.2015

The International Conference on Understanding and Controlling Nano and Mesoscale Friction, Istanbul, Turkey

Oral Contributions

Determination of Torsional Spring Constant of Atomic Force Microscopy Cantilevers: Combining Normal Spring Constant and Classical Beam Theory
Rubén Álvarez-Asencio, E. Thormann, and M. W. Rutland

Nanowear control of polymer thin films using ultrasonic vibrations

P. Pedraz, R. Wannemacher, F. Dinelli, P. Pingue, E. Gnecco

Adhesion and movement of nanoparticles and stem cells on nanorippled glass surfaces

S. Casado, P. Pedraz, A. Ayuso, F. B. de Monte, E. Gnecco

29.06-26.06.2015

XVI Congress SEBEC, Seville, Spain

Poster Contributions

Evaluation of doxorubicin delivered by magnetic nanoparticles in MDA-MB-231 breast cancer cells

Macarena Calero; Bruno Simoes; Alfonso Latorre; Pierre Couleaud; Antonio Aires; Ana Lazaro-Carrillo; Álvaro Somoza; Aitziber López Cortajarena; Robert Clarke; Angeles Villanueva.

05-10.07.2015

XX International Conference on Magnetism, Barcelona, Spain

Oral Contributions

Magnetite Nanotubes and Nanorods: Microstructures and Magnetism

Feng Luo, Chunjia Jia Lingdong Sun, and Chunhua Yan

Thermal dependencies of the magnetic symmetries of low dimensionality systems, studied with novel variable temperature/full angular range vectorial MOKE technique

JLF Cuñado; Javier Pedrosa; Paolo Perna; Alberto Bollero; Fran Terán; Julio Camarero; Rodolfo Miranda.

BH enhancement in SrFe₁₂O₁₉ hybrid nanocomposites

A.M. Aragon, A. Quesada, A. Bollero, S. Deledda, J.F. Fernández, A. Hernando, P. Marín

Extraordinary "EB-like" phenomenon in orthogonally coupled ferromagnets: SmCo₅ (perpendicular) /CoFeB and /NiFe (in-plane) bilayers

A. Bollero, F.J. Pedrosa, J.L. Fdez Cuñado, J. Camarero, M. Seifert, V. Neu, V. Baltz, D. Serantes, O. Chubykalo-Fesenko, R. Pérez del Real

Tuning magnetic properties of isotropic ferrite powders as a feasible alternative for permanent magnet applications

F.J. Pedrosa, K. Golasinski, J. Rial, A. Quesada, F. Rubio, Marcos, M. N. Guzik, S. Deledda, J.F. Fernández, J. Camarero, A. Bollero

Experimental evidences of first-time reported (100) in-plane easy axis in magnetite films grown onto different single-crystal substrates

J.Fdez Cuñado, F.Pedrosa, M.Sanz, M.Oujja, E.Rebollar, J.Marco, J.de la Figuera, M.Monti, M.Castilleo M.García-Hernández, F.Mompeán, N.M.Nemes, N.Balint, J.Camarero, A.Bollero

Magnetization enhancement through exchange-coupling in $\text{CoFe}_2\text{O}_4/\text{CoFe}_2$ Nanocomposites

C. Granados Miralles, A. Quesada, M. Stingaciu, F. Rubio, Marcos, F.J. Mompeán, M. García Hernández, F.J. Pedrosa, A. Bollero, J.F. Fernández, M. Christensen

Poster Contributions

Origin of Anisotropic Giant Magnetoresistance in magnetic nanostructures

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

Interfacial coupling induced symmetry-breaking of spin-orbit interaction in exchanged biased system

P. Perna, D. Maccariello, F. Ajejas, J. Luis F. Cuñado, R. Guerrero, M. A. Niño, A. Bollero, J. Pedrosa, J. Camarero, R. Miranda

Emergence of coherent magnetization reversal at dynamic regime: a detailed vectorial-- resolved angular-- dependent study.

J. Camarero, T. Pérez, J. F. Cuñado, A. Maldonado, P. Perna, F. Ajejas, S. L. de las Heras, M. Niño, D. Cabrera, R. Guerrero

Angular-dependent magnetic properties of exchange-coupled ferromagnetic and multiferroic BiFeO_3 thin films

Paolo Perna; Davide Maccariello; Fernando Ajejas; JLF Cuñado; Sergio de las Heras; Jullie Albille; Cyrille Deranlot; Agnes Bartelety; Julio Camarero; Manuel Bibes; Rodolfo Miranda

Modulation of interacting phenomena in iron oxide nanoparticle colloids

D. Cabrera, D. Ortega, G. Salas, and F. J. Teran

Magnetisation reversal in Co nanoparticle arrays on corrugated $\text{MnF}_2(110)$ surface

S. Gastev, B. Krichevtsov, D. Baranov, V. Fedorov, S. Sutturin, N. Sokolov, J.L.F. Cuñado, A. Bollero, J. Camarero

Crystal domains and magnetic glassy state in Co-ferrite nanoparticles

C. Moya, G. Salas, M. Morales, X. Batlle, A. Labarta

Influence of core-to-aggregate dipole interactions in the heating capacity of magnetic hyperthermia agents

C. Blanco-Andujar, P. Southern, L.K. Bogart, Q.A. Pankhurst, C. Grüttner, M. del Puerto Morales, D. Ortega

Stability and cellular uptake of anionic iron oxide nanoparticles for hyperthermia

D. Soukup, S. Moise, E. Cespedes, J. Dobson, N. Telling

05-10.07.2015

16th International Symposium on Novel Aromatic Compounds (ISNA-16), Madrid, Spain

Contributions

Synthesis of Ruthenium Complexes and their Interaction with DNA

Romina Lorca, Iria Salvadó, M. Eugenio Vázquez, Miguel Vázquez López, and Álvaro Somoza

Poster Contributions

Donor-acceptor subphthalocyanine oligomers: Towards polarized π -extended curved molecules

M. V. Martínez-Díaz, G. Zango, L. Tejerina, G. Bottaria, T. Torres

New A-D-A Small Molecules Based on BDT

Rafael Sandoval, José Santos, Nazario Martín.

Key Structural Motifs Determining the Hosting Cages in Endohedral Metallofullerenes

Wang, Yang; Díaz-Tendero, S.; Alcamí, Manuel; Martín, Fernando

Efficient Liquid-Phase Exfoliation of Two-Dimensional (2D) Layered Materials under Mild Conditions

M. Mar Bernal





Covalent Patterning of Graphene with Periodicity at the Nanometer Scale

Sofia Leret García

Study of Intermolecular Hydrogen Bonds at a Single Molecule Level

Teresa Naranjo

Small Substituent - Strong Effect: Impact of Fluorination on the Photophysics in Ladder-Type Quaterphenyl

Benedikt Dänekamp

New Hole Transporting Materials for Perovskites Solar Cells

Inés García Benito

Solid State Luminescence Enhancement in Dicyano-Distyrylbenzenes: Intra- and Intermolecular Contributions

Junqing Shi

Determination of Association Constants from Thermogravimetric Analysis on Carbon Nanotubes

Alberto De Juan

Porphyrins for the Synthesis of Mechanically Interlocked Single-Wall Carbon Nanotubes

Leire De Juan Fernández

06-09.07.2015

10th European Biophysics Congress (EBSA 2015), Dresden, Germany

Oral Contribution

Mechano-chemical kinetics of DNA replication: identification of the translocation step of a replicative DNA polymerase

Morín, J.A., Cao, J.M., Salas, M., Ibarra, B.

Poster Contributions

Single-stranded RNA interaction with long human telomeric RNA unveiled at the single-molecule level

I. Gutiérrez, M. Garavís, S. Casado, C. González, A. Villasante and J.R. Arias-González

Two scale levels for the computational modeling of DNA/RNA quadruplexes

A.E. Bergues-Pupo, J.R. Arias-Gonzalez, M.C. Morón, A. Fiasconaro, and F. Falo

A protein with dsRNA binding activity enhances the mechanical stability of the birnavirus capsid.

J. Mertens, S. Casado, C. Mata, M. Hernando-Pérez, P. de Pablo, J. Castón and J.L. Carrascosa

Iron quantification inside cells incubated with SPION by Soft X-ray Absorption Spectro-Tomography

J. Conesa, F.J. Chichón, M. Chiappi, E. Pereiro and José L. Carrascosa

Towards high-throughput screening of photosensitizing fluorescent proteins

Alberto Rodríguez-Pulido, Aitziber L. Cortajarena, Cristina Flors

Control of neural stem cell functions on 1D polymer topographies.

Viela, Felipe; Ayuso, Ángel; Granados, Daniel; Rodríguez Osorio, Manuel; Rodríguez, Isabel

Biomechanical cell regulation by high aspect ratio nanoimprinted pillars.

Viela, Felipe; Ayuso, Ángel; Granados, Daniel; Rodríguez Osorio, Manuel; Rodríguez, Isabel.

Replication dynamics of the human mitochondrial DNA polymerase

Cerrón, F., Cao, J.M., Kaguni L.S., Ibarra, B.

Single molecule mechanical characterization of the HmtSSB binding properties to ssDNA

Morín, J.A., Kaguni, L.S., Ibarra, B.

12-16.07.2015

8th International Workshop on Nanoscale Pattern Formation at Surfaces, Krakow, Poland

Oral Contribution

Surface rippling in abrasive nanowear: A novel interpretation and ways to prevent it

E. Gnecco, R. Wannemacher, P. Pedraz

13-17.07.2015

XXXV Reunión Bienal de la RSEF y 25º Encuentro Ibérico de Enseñanza de la Física, Gijón, Spain

Oral Contribution

Control cuántico de las propiedades termoeléctricas en uniones moleculares

Laura Rincón-García, C. Evangeli, N. Agrait

19-21.07.2015

24th International Symposium on Ion Atom Collisions (ISIAC), Barcelona, Spain

Oral Contribution

Dynamics of fusion reactions of fullerenes induced by ion collisions

Wang, Michael Gatchell, Henning Zettergren, Patrick Rousseau, Tao Chen, Mark H. Stockett, Alicja Domaracka, Lamri Adoui, Bernd A. Huber, Henrik Cederquist, Manuel Alcamí, and Fernando Martín

Poster Contribution

Ion-induced molecular growth inside polycyclic aromatic hydrocarbon clusters

Wang, Yang; Delaunay, Rudy; Gatchell, Michael; Rousseau, Patrick; Domaracka, Alicja; Maclot, Sylvain; Stockett, Mark H.; Chen, Tao; Adoui, Lamri; Cederquist, Henrik; Zettergren, Henning; Huber, Bernd A.; Alcamí, Manuel; Martín, Fernando

22-25.07.2015

The 29th annual symposium of the protein society, Barcelona, Spain

Poster Contribution

Impact of the chaperonin CCT in α -Synuclein (A53T) amyloid fibril assembly.

Ahudrey Leal-Quintero; Javier Martinez Sabando; Jose María Valpuesta; Begoña Sot

22-28.07.2015

The XXIX International Conference on Photonic, Electronic, and Atomic Collisions (ICPEAC), Toledo, Spain

Poster Contributions

Fusion reaction dynamics of fullerene molecules
 Wang, Yang; Gatchell, Michael; Zettergren, Henning; Rousseau, Patrick; Chen, Tao; Stockett, Mark H.; Domaracka, Alicja; Adoui, Lamri; Huber, Bernd A.; Cederquist, Henrik; Alcamí, Manuel; Martín, Fernando

X-ray induced fragmentation dynamics of doubly charged L-alanine in gas phase

Wang, Yang; Levola, H.; Rossich, E.; Piekarski, D.; Díaz-Tendero, S.; Kukuk, E.; Alcamí, Manuel; Martín, Fernando

23-25.07.2015

Physical properties of nanoparticles: Characterization and applications. DPG, Bad Honnef, Germany

Poster Contribution

Silica encapsulation of magnetic nanoparticles

L.de la Cueva, P.Rodríguez, R.Amaro, D.Cabrera, M.Acebrón, B.H.Juárez F.J.Teran, and G.Salas

26-31.07.2015

EMRS, Warsaw, Poland

Oral Contribution

Tuning positive and negative low-field anisotropic magnetoresistance in half-metallic epitaxial La_{0.7}Sr_{0.3}MnO₃ thin films

Paolo Perna; Fernando Ajejas; Davide Maccariello; Ruben Guerrero; Laurence Méchin; Stephane Flament; Julio Camarero; Rodolfo Miranda

31.08-04.09.2015

European Congress on Surface Science (ECOSS), Barcelona, Spain

Oral Contributions

Long range magnetic order in a 2D organic system

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

Probing the site-dependent Kondo response of nanostructured graphene with organic molecules

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

Spatial variation of giant spin-orbit effect induces electron confinement in graphene on Pb islands

F. Calleja, H. Ochoa, J.J. Navarro, M. Garnica, S. Barja, A. Black, M.M. Otrokov, E.V. Chulkov, A. Arnau, A.L. Vázquez de Parga, F. Guinea and R. Miranda

Achieving long range magnetic order on a monolayer of TCNQ adsorbed on graphene/Ru(0001)

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

31.08-04.09.2015

European Society for Photobiology Congress, Aveiro, Portugal

Oral Contribution

Real-time imaging of photodynamic action in bacteria

Anita Gollmer, Ariane Felgentraeger, Tim Maisch, Cristina Flors

Poster Contribution

Screening genetically-encoded photosensitizers for correlative microscopy: a fast and efficient method for detecting their ROS generation

Alberto Rodríguez-Pulido, Aitziber L. Cortajarena, Cristina Flors

01-05.09.2015

13rd European Conference on Molecular Electronics (ECME-2015), Strasbourg, France

Poster Contribution

Towards multiple conductance pathways with heterocycle-based oligo(phenyleneethynylene) derivatives

D. Miguel, L. Álvarez de Cienfuegos, A. Martín-Lasanta, S. P. Morcillo, L. A. Zotti, E. Leary, M. Burkle, Y. Asai, R. Jurado, D. J. Cárdenas, G. Rubio-Bollinger, N. Agraït, J. M. Cuerva, M. T. González

08-11.09.2015

2015 IEEE EUROCON 2015, Salamanca, Spain

Oral Contribution

CoFe₂O₄ isotropic powders for permanent magnet applications

F.J. Pedrosa, J. Rial, K. Golasinski, J. Camarero and A. Bollero

09-11.09.2015

4th Joint Congress of the Portuguese and Spanish Microscopy Societies, Porto, Portugal

Oral Contribution

Quantitative Soft-X ray Absorption Spectro-Tomography of iron inside cells incubated with SPION

José Javier Conesa, Francisco Javier Chichón, Michele Chiappi, Eva Pereiro and José L. Carascosa

13-16.09.2015

Methods and Applications of Fluorescence, Würzburg, Germany

Oral Contribution

Photosensitizing fluorescent proteins as tags for correlative microscopy

Alberto Rodríguez-Pulido, Aitziber L. Cortajarena, Rubén Ruiz-González, Joaquim Torra, Santi Nonell, Cristina Flors

Poster Contribution

Correlative super-resolution fluorescence imaging and atomic force microscopy for the characterization of β -lactoglobulin fibrils

Patricia Bondia, Santiago Casado, Rocío Jurado, José M. Domínguez-Vera, Natividad Gálvez, Cristina Flors

14-16.09.2015

Nanopyme Workshop: rare earth-free permanent magnets and applications, Madrid, Spain

Oral Contributions

Magnetic behaviour of M-type strontium hexaferrite thin films prepared by sputtering.

Rodríguez Osorio, Manuel

Isotropic SrFe₁₂O₁₉ powders obtained by rapid-milling for permanent magnet applications.

Rodríguez Osorio, Manuel

Hybrid ferrite permanent magnet

Ana M. Aragón, Adrián Quesada, Alberto Bollero, Stefano Deledda, José Francisco Fernández, Antonio Hernando, Pilar Marín

Magnetic behaviour of M-type strontium hexaferrite thin films prepared by sputtering

Eva Céspedes, Cristina Navío, Gabriel Rodríguez-Rodríguez, Federico J. Mompeán, Mar García, Manuel R. Osorio, Fco Javier Pedrosa, Adrián Quesada and Alberto Bollero

Micromagnetic untangling of the magnetic behavior of polycrystalline M-type strontium hexaferrite thin films

Gabriel Rodríguez-Rodríguez, Eva Céspedes, Cristina Navío, Karol Golasinskia and Alberto Bollero



From the lab into the factory: Cost-effective recycling of ferrites wastes for permanent magnets applications

Alberto Bollero, Javier Pedrosa, Javier Rial, Jose Luis F. Cuñado, Judit Almunia, Ana Seoane, Matylda Guzik, Stefano Deledda, Julio Camarero and Ricardo Altimira

High-coercive isotropic CoFe₂O₄ powders prepared by the ultra-fast ball milling technique

Fco. Javier Pedrosa, Javier Rial, Adrián Quesada, Fernando Rubios-Marcos, Matylda N. Guzik, Stefano Deledda, José Fco. Fernández, Julio Camarero and Alberto Bollero

Poster Contributions

Isotropic SrFe₁₂O₁₉ powders obtained by rapid-milling for permanent magnet applications

K.M. Golasinski, F.J. Pedrosa, E. Céspedes, G. Rodríguez-Rodríguez, M.R. Osorio, D. Granados, J. Camarero, and A. Bollero

High coercive isotropic CoFe₂O₄ powders obtained by ultrafast-milling

J. Rial, F.J. Pedrosa, K.M. Golasinska, A. Quesada, F. Rubio-Marcos, M.N. Guzik, S. Deledda, J.F. Fernández, J.Camarero, and A. Bollero

Influence of ultra-short cryomilling on the microstructural and magnetic properties of cobalt ferrite

Matylda N. Guzika, Karol Golasinski, Petra Jenuša, Alberto Bollero, Bjørn C. Hauback, Stefano Deledda

Experimental evidences of first-time reported (100) inplane easy axis in magnetite films grown onto different single-crystal substrates

F.J. Pedrosa, J.L. Fernández-Cuñado, J. Rial, M. Sanz, M. Oujjac, E.Rebollar, J.F. Marco, J. de la Figuera, M. Monti, M. Castillejo, M. García-Hernández, F. Mompeán, N.M. Nemes, T. Feher, B. Nafradi, L. Forro, J.Camarero, and A. Bollero

Permanent magnets: From nanostructured thin films to powder-like systems micromagnetics

G. Rodríguez-Rodríguez, K.M. Golasinski, F.J. Pedrosa, E. Céspedes, J. Camarero, and A. Bollero

14-18.09.2015

International Conference on Single-Molecule Electronics, Regensburg, Germany

Oral Contribution

Adsorbate-induced curvature and stiffening of graphene

Simon Svatek, N. Agrait

Poster Contribution

Mechanically tunable thermopower of single-molecule junctions

Laura Rincón-García, C. Evangelini, N. Agrai

21-24.09.2015

MNE (Micro and Nano Engineering: The Hague, the Netherlands

Poster Contribution

Biomechanical Cell Regulation by High Aspect Ratio Nanoimprinted Pillars

Felipe Viela, Daniel Granados, Angel Ayuso-Sacido, Isabel Rodríguez

27-30.09.2015

XII Italian Conference on Supramolecular Chemistry (Supramol 2015), Giardini Naxos, Italy

Oral Contribution

Unprecedented regio-, stereo- and atropselective synthesis of an "elusive" cis-1 C₆₀ fullerene bisadduct racemate by supramolecular-directed functionalization

G. Bottari

07-09.10.2015

22nd International Workshop on Oxide Electronics (WOE22), Paris, France

Poster Contributions

Substrate strain induced effects in

La_{0.7}Sr_{0.3}mno₃ thin films

Sandeep Kumar Chaluvadi; Paolo Perna; Fernando Ajejas; Julio Camarero; Laurence Méchin



Tuning positive and negative low-field anisotropic magnetoresistance in half-metallic epitaxial La_{0.7}Sr_{0.3}MnO₃ thin films

Paolo Perna; Fernando Ajejas; Davide Maccariello; Ruben Guerrero; Laurence Méchin; Stephane Flament; Julio Camarero; Rodolfo Miranda

19-20.10.2015

BioMapp 2015, San Sebastian, Spain

Oral Contribution

Functional nanostructures by designed protein self-assembly

Sara H.Mejias, Aitziber L. Cortajarena

25-29.10.2015

8th European School on Molecular Nanoscience (ESMolNa 2015), Paris, France

Poster Contribution

Functional nanostructures by designed protein self-assembly

Sara H.Mejias, Aitziber L. Cortajarena

Oral Contribution

Oligoynne-based thermoelectricity

Laura Rincón-García, C. Evangeli, N. Agrait

27-28.10.2015

Critical Metal Symposium, Sendai, Japan

Poster

"Hybrid ferrites for permanent magnet applications: from processing to industrial recycling and proven functionality" IMDEA

01-04.11.2015

NCRI CANCER CONFERENCE, Liverpool, UK

Poster Contribution

Relationship between cellular accumulation and cytotoxicity of photoactivatable cisplatin-related prodrugs

Ana M. Pizarro; Ruth J. McQuitty; Fiona S. Mackay; Yao Zhao; Julie A. Woods; Peter J. Sadler

03-06.11.2015

Chirality at the Nanoscale, Leuven, Belgium

Oral Contribution

Enantiospecific spin polarization from adsorbed organic chiral molecules

J.J. de Miguel, M. A. Niño, I. Kowalik, F.J. Luque, D. Arvanitis, R. Miranda

08-12.11.2015

SGN6, Hamamatsu, Japan

Oral Contribution

Sputtering parameters effect on the growth of AlInN on p-Si (111) for photovoltaic applications

Aránzazu Núñez - Cascajero; Laura Monteagudo - Lerma; S Valdueza - Felip; Cristina Navío; Miguel González - Herráez; FB Naranjo.

11-13.11.2015

IX Meeting of Protein Structure and Function Network, Seville, Spain

Oral Contribution

Functional nanostructures by designed protein self-assembly

Sara H.Mejias, Aitziber L. Cortajarena

29.11-04.12.2015

Materials Research Society, Boston, USA

Oral Contribution

Experimental Realization of Non-volatile Memory: A Nanodevice Based on the Interplay Between Superconducting Ratchet Effect and Out of Plane Magnetization.

A. Gomez, J. del Valle, E. M. Gonzalez, M R. Osorio, D. Granados, J. L. Vicent

18.12.2015

XVIII Jornada de Jóvenes Investigadores del Instituto de Ciencia de Materiales Nicolás Cabrera (INC), Miraflores, Spain

Poster Contribution

Quantum thermopower of metallic atomic-size contacts at room temperatura

Laura Rincón-García, C. Evangeli, N. Agrait



IMDEA Nanociencia Madrid,
15-16 June 2015
**Meeting PHOCS “Photogenerated Hydrogen
by Organic Catalytic Systems”**



IMDEA Nanociencia Madrid,
22-23 June 2015
**FINAL Meeting MULTIFUN “MultiFunctional Nanotech-
nology for Selective Detection and Treatment of Cancer”**



IMDEA Nanociencia Madrid,
17-18 June 2015
**5th Workshop for Early Stage Researchers
in Nanoscience**



IMDEA Nanociencia Madrid,
14-16 September 2015
**Workshop NANOPYME “Nanocrystalline Permanent
Magnets Based on Hybrid Metal-Ferrites”**



3.4. Seminars

Wednesday, January 8, 2015

Atom-thick Materials for the Next Revolution in Electronics

Prof. Tomás Palacios

*Microsystems Technology Laboratories
Massachusetts Institute of Technology, Cambridge, US*

Friday, January 9, 2015

Nanoscale heating in oncology: new insights

Dr. Daniel Ortega

IMDEA Nanociencia, Madrid, Spain

Tuesday, January 20, 2015

Nanotools for DNA repair

Dr. Humberto Sánchez

Erasmus MC University Medical Center Rotterdam, Holland

Thursday, January 22, 2015

Highly organized porous electrodes

Prof. Alexander Kuhn

Université de Bordeaux, France

Tuesday, January 27, 2015

Solution Processed Inorganic and Organic Materials for Device Applications

Dr. Emilio J. Palomares Gil

Institute of Chemical Research of Catalonia (ICIQ), Tarragona, Spain

Monday, February 2, 2015

Novel Materials, Architectures and Methods for Electrocatalysis in Fuel Cells

Prof. Dr. Hector Abruña

*Cornell University
Chemistry and Chemical Biology, Ithaca, NY, USA*

Thursday, February 5, 2015

Learning physics of bioassemblies with (more than) an atomic force microscope: surface properties, dynamics &...

Dr. Susana Moreno Flores

Austrian Science Funds (FWF), Vienna, Austria

Friday, February 6, 2015

Photoactive host-guest systems based on porous frameworks

Dr. Fabio Cucinotta

Newcastle University, Italy

Tuesday, February 10, 2015

Can nanomedicine help treating cardiovascular disease?

Dr. Borja Ibáñez

*Fundación Centro Nacional de Investigaciones Cardiovasculares Carlos III (CNIC)
Madrid, Spain.*

Tuesday, February 24, 2015

Molecular nanoparticles based on cubic silsesquioxanes

Dr. José Luis Chiara

*Instituto de Química Orgánica General (IQOG-CSIC)
Madrid, Spain.*

Tuesday, April 7, 2015

Cancer gene and cell therapies using adenoviral vectors. Nanotechnological tropism modifications

Dr. Pilar Martín Duque

*Instituto Aragonés de Ciencias de la Salud-IACS,
Zaragoza, Spain*

Tuesday, April 21, 2015

Magnetic reversal and magneto-plasmonics of Au/Co/Au nanoring based structures by Hole mask colloidal lithography

Dr. Feng Luo

IMDEA Nanociencia, Madrid, Spain

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www.nanociencia.imdea.org

seminar
Friday April 24th
of Faraday, 9
Sala de Conferencias, IMDEA
Nanociencia
Ciudad Universitaria de Cantoblanco

12.00h Single cell laser photodynamics: Femtosecond lasers as tools to modulate cell physiology
Dr. Alfonso Blázquez-Castro
Department of Chemistry, University of Aarhus & Aarhus Institute for Advanced Studies, Denmark

IMDEA Nanociencia

Friday, April 24, 2015

Single cell laser photodynamics: Femtosecond lasers as tools to modulate cell physiology

Dr. Alfonso Blázquez-Castro
Department of Chemistry, University of Aarhus & Aarhus Institute for Advanced Studies, Denmark

Tuesday, May 5, 2015

2D Materials & Device

Dr. Andrés Castellanos
IMDEA Nanociencia, Madrid, Spain

Tuesday, July 21, 2015

From the Cell to the Cosmos: Local Bonding and Consequences in Ferrous Magnetic Materials for Advanced Applications

Prof. Laura H. Lewis
*Cabot Professor, Department of Chemical Engineering
Department of Mechanical and Industrial Engineering
Northeastern University, Boston, MA, U.S.A.*

Tuesday, May 19, 2015

Sidechain control of peptide-based porous materials

Dr. C. Martí-Gastaldo
Universidad de Valencia, Instituto de Ciencia Molecular, Valencia, Spain

Thursday, September 10th

Thermal Properties of 3D Graphene Filled Polymer Composites

Prof. Shu-Lin Bai
*Dept. of Materials Science and Engineering,
College of Engineering, Peking University*

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seminar
Friday June 19th
of Faraday, 9
Sala de Conferencias, IMDEA
Nanociencia
Ciudad Universitaria de Cantoblanco

12.00h Functional Materials Synthesized by On-Surface Chemistry
Dr. Dimas G. de Oteyza
Donostia International Physics Center, Donostia / San Sebastián, Spain

IMDEA Nanociencia

Friday, June 19, 2015

Functional Materials Synthesized by On-Surface Chemistry

Dr. Dimas G. de Oteyza
Donostia International Physics Center, Donostia / San Sebastián, Spain

Thursday, October 15, 2015

OPE3, the 'fruit fly' of molecular-scale electronics: experiments at the single-molecule level

Dr. Riccardo Frisenda
Delft University of Technology, The Netherlands

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seminar
Thursday July 16th
of Faraday, 9
Sala de Conferencias, IMDEA
Nanociencia
Ciudad Universitaria de Cantoblanco

15.30h Surface-confined polymerization by Ultramere and Schiff-base coupling reactions
Dr. Giorgio Contini
Istituto di Struttura della Materia, CNR University of Rome "Tor Vergata", Roma, Italy

IMDEA Nanociencia

Tuesday, June 23, 2015

Atomic-level structure characterization of an ultra-fast folding mini-protein denatured state

Dr. Lars T. Kuhn
Göttingen Graduate School for Neurosciences, Biophysics, and Molecular Biosciences (GGNB) Germany

Thursday, October 29, 2015

Functional Materials Synthesized by On-Surface Chemistry

Dr. Guy Le Lay
Université Aix-Marseille, Marseille, France

Tuesday, June 30, 2015

A structural biology perspective on key folding and cluster assembly pathways in mitochondria

Dr. Angelo Gallo
CERM and Department of Chemistry, University of Florence, Sesto Fiorentino, Italy

Wednesday, November 25, 2015

Covalent functionalization of carbon nanotubes and graphene for catalysis applications

Dr. Matias Blanco
Instituto Nacional del Carbón - CSIC, Oviedo, Spain

Thursday, July 16, 2015

Surface-confined polymerization by Ullmann and Schiff-base coupling reactions

Dr. Giorgio Contini
Istituto di Struttura della Materia, CNR University of Rome "Tor Vergata", Roma, Italy

Thursday, December 10, 2015

Chiral Supramolecular Structures: Circular Dichroism Spectroscopies

Dr. Belén Nieto-Ortega
University of Malaga, Department of Physical Chemistry, Málaga, Spain



3.5. Projects

3.5.1. International programmes

3.5.1.1. H2020

NANOLEAP

“Nanocomposite for building constructions and civil infrastructures: European network pilot production line to promote industrial application case”

Funding: H2020-NMP-PILOTS-2014 no 646397

Duration: 2015-2018

IMDEA Research Team: Dr. M^a Isabel Rodriguez (PI)

<http://www.nanoleap.eu/>

The NANOLEAP project brings together a European Network of pilot facilities focused on scaling up innovative nanocomposite based technologies and processing methods for the construction sector.

Through an open access to the pilot facilities, the goal of this infrastructure is to support the research activities of European SMEs in the construction sector enabling the progress of nanocomposite products to next steps of technology deployment and to enter in the commercialization stage.

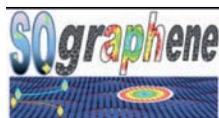
Ten pilot plants participate in the network developing innovative applications of polymeric nanocomposites in the areas such as:

- Coated nanoparticles with improved compatibility with the matrix
- Antiweathering and anticorrosion nanocomposite coatings for the protection of structures exposed to aggressive environments
- Multifunctional polymeric nanocomposites providing environmental resistance (anti-microbial, UV protection) and smart applications to traditional construction materials self-cleaning, hydrophobicity, early warning crack or water leak alarm
- Prefab lightweight elements such as aerogels mechanically reinforced with nanoparticles for high thermal insulation applications

IMDEA Nanoscience with an imprinting roll to roll pilot plant participates actively in the development of multifunctional polymeric nanocomposites through surface nano engineering.



3.5.1.1.1. Era Learn 2020



SOGraph

“Tailoring Spin-Orbit effects in graphene for spin-orbitronic applications”

Funding: FLAG ERA Graphene Flagship. EU-Framework Programme Horizon 2020 and Ministerio de Economía y Competitividad.PCIN-2015-111

Consortium of 4 European partners coordinated by IMDEA Nanociencia

Duration: 2015-2018

IMDEA Research team: Prof. Rodolfo Miranda (PI), Prof. Francisco Guinea (PI)

The development of *all-graphene spintronic* devices requires that, in addition to its passive capability to transmit spins over long distances, other active properties are incorporated to graphene. Recent advances by some of the partners have led to the generation of long range magnetic order and spin filtering in graphene by molecular functionalization as well as the introduction of giant spin-orbit coupling (SOC) in the electronic bands of graphene by intercalation of Pb.

The **SOgraphene** project incorporates these developments as the base for designing novel *nanoarchitectures* targeting the investigation of the role and the control of SOC in graphene as a source of large chiral exchange interaction, commonly known as Dzyaloshinskii–Moriya interaction (DMI), leading to stabilization and manipulation of magnetic skyrmions, and/or as efficient source of large pure spin current by *Spin Hall Effect (SHE)*.

SOgraphene aims to i) **create**, ii) **characterize**, iii) **image**, and iv) **test** all-graphene spin-orbitronic systems/devices functional at room temperature (RT) by exploiting the advantages of combining ferromagnetic (FM) and/or non-magnetic (NM) heavy metals underneath of a graphene (gr) layer. In particular, the following stack sequences gr/Pb/Co/NM2 and gr/Pb/insulating will be explored. Different issues will be addressed: a) induce large interfacial chiral interactions and skyrmions in perpendicular magnetic anisotropy (PMA) ultra-thin Co layers in proximity with Pb, b) induce SOC and SHE in graphene by the proximity of Pb; and c) the combined proximities of graphene with Pb and Co to imprint skyrmionic textures into graphene. For the three cases, the gate-tunability of graphene would, in addition, allow electric field control of such interface-induced effects. In view of practical applications, *SOgraphene* will open the way for the development of the next generation of low-power, faster and smaller spin-orbitronic devices in 21st century.

MOFsENS

“Synthesis of metal-organic frameworks as optical gas sensors”

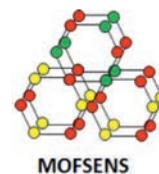
Funding: M-ERA.NET, EU-Framework Programme Horizon 2020 and Ministerio de Economía y Competitividad. PCIN-2015-169-C02-01

Consortium of 3 European partners coordinated by the University of Porto

Duration: 2015-2018

IMDEA Research team: Dr. Juan Cabanillas-González (PI)

The main objective of this project is the synthesis of gas sensitive metal-organic frameworks (MOFs) and the development of optical sensors based on thin films of these materials. The main innovation in the proposed MOF is centered on the use of new fluorescent organic bridging ligands, exploiting both the emission sensing properties of the fluorophore and the excellent sorbing capabilities of the MOF structure. We will focus on the monitoring of harmful gases and chemical vapors in order to protect human health and the environment. Devices for gas monitoring which are multi-use, selective and user-friendly are widely pursued, in order to avoid hazardous exposure to deteriorated environments. Despite of the intensive research in the field of MOF materials, there are only a few examples exploiting their use as optical gas sensors. On the other hand, these studies appear outside of Europe. Thus, an EU network program as M-ERA.NET is the appropriate tool to combine the expertise and knowledge to develop the present proposal.



MOFsENS



NEXMAG

“New Exchange-Coupled Manganese-Based Magnetic Materials”

Funding: M-ERA.NET, EU-Framework Programme Horizon 2020 and Ministerio de Economía y Competitividad. PCIN-2015-126

Consortium of 3 European partners coordinated by IMDEA Nanociencia

Duration: 2015-2018

IMDEA Research team: Dr. Alberto Bollero (PI)

NEXMAG aims at developing **RE-free PMs** as alternative to controversial Nd-Dy-Fe-B magnets. Among the different alternatives, MnAl is a promising choice due to the abundance of the constituent elements and potential magnetic properties. **MnBi** can provide additional information in the understanding of magnetic properties for Mn-based magnets. NEXMAG project will focus in **nanocomposite Manganese-based materials** and will make use of an approach based on the exchange-coupling phenomenon between two complementary phases:





1. Magnetically hard phases: MnAl; MnBi
2. Magnetically soft phases: metals (Fe, FeCo)

Despite of single-phase MnAl and MnBi systems being extensively studied in recent years, many fundamental questions still remain unanswered, resulting in experimental $(BH)_{max}$ values (figure of merit for assessment of the magnetic quality) well below theoretical predictions.

3.5.1.2. Marie Skłodowska-Curie Action

E-GRA-MONS OPTICS

“Quantum Emitters to Graphene Plasmons: a new route towards fast Quantum Optics”

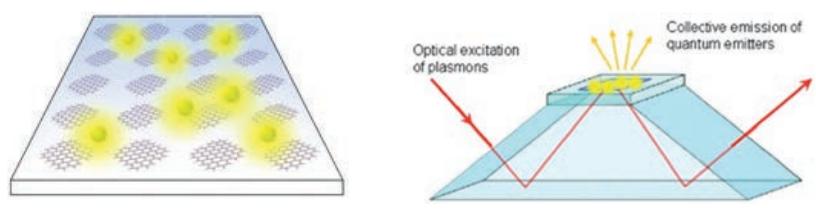
Funding: **H2020-MSCA-IF-2014 no 660732**

Duration: 2015-2017

PI: Dr. Daniel Cano



E-GRA-MONS OPTICS aims to couple quantum emitters (e.g. quantum dots and endohedral fullerenes) to the strong electric fields of graphene plasmons with the ultimate goal of performing fast quantum operations in the near infrared and visible spectrum. Such an integrated system will overcome the low processing speed of atoms and photons, thus providing a robust, solid-state platform for fast quantum optics. The real challenge is to integrate the features of quantum emitters and graphene plasmons into a single functional nanomaterial, understanding how the interactions at the nano-scale can impact its optical properties. The main objective is the experimental demonstration of strong emitter-plasmon coupling and plasmon-mediated interactions between emitters, which will be the fundamentals of novel quantum-optics technologies.



3.5.1.3. Seventh Framework Programme

ERC

NOVGRAPHENE

Novel uses for graphene

Funding: ERC-2011-ADG_20110209

Duration: 2012-2017

PI: Prof. Francisco Guinea

Models for novel uses of graphene, not feasible in other materials, will be developed. Emphasis will be made on properties unique to graphene, like its extremely high stiffness, flexibility, tunable metallic features, and very low mass density. Novel applications will be studied in the areas of i) structural deformations and modulation of electronic properties, ii) spin manipulation, and iii) optoelectronics and plasmonics.

MOLHREOSTAT

Downhill Folding Protein Modules as conformational

Rheostats: Roles in Molecular Biology and Applications in Biosensors

Funding: ERC-2012-ADG_20120314-no 323059

Duration: 2014-2018

PI: Prof. Víctor Muñoz (CNB-CSIC).

IMDEA Nanociencia as third party linked to CSIC via the “*Unidad de Nanobiotecnología CNBCSIC-IMDEA Nanociencia Joint Unit CNBCSIC*”

Protein folding and function is a perfect arena towards growing the grassroots of quantitative and synthetic biology. This is so because all cellular processes controlled by proteins can ultimately be traced back to physico-chemical properties encoded in their aminoacid sequences. MOLRHEOSTAT is framed within these goals, focusing on the investigation of novel connections between protein folding and function via a multi-disciplinary approach that combines experiment (single molecule spectroscopy, high-resolution NMR, protein engineering and design), theory and computer simulations. Conventionally, proteins are portrayed as conformational switches that fold and function by flipping between an on-state (native, active) and an off-state (inactive, unfolded) in response to stimuli. However, last years have witnessed the discovery of protein modules that undergo continuous conformational changes upon unfolding (downhill folding).



European Research Council
 Established by the European Commission



European Research Council
 Established by the European Commission

MOLRHEOSTAT aims at investigating the functional and technological implications of downhill folding. The goal is to determine whether downhill folding modules can be exploited to build conformational rheostats; that is, proteins that continuously modulate a signal or response at the single molecule level by tuning their folding conformational ensemble. Conformational rheostats could open a new realm of applications as synthetic biomolecular devices as well as regulatory mechanisms for controlling complex biochemical processes carried out by macromolecular assemblies.

These ideas will be explored on two specific objectives:

1. Implementation of a general approach for building high-performance, ultrafast, single-molecule sensors based on downhill protein folding modules.
2. Analysis of the roles of conformational rheostats in the regulation of three fundamental processes in molecular biology (coordination in protein networks, DNA sliding and homing-to-target of transcription factors, and molecular springs in macromolecular assemblies).



European Research Council
Established by the European Commission

MINT

“Mechanically Interlocked Carbon Nanotubes”

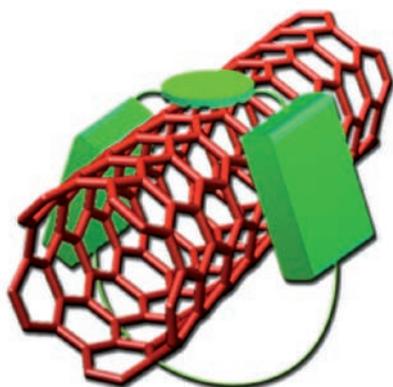
Funding: ERC-2012-StG_20111012 n° 307609

Duration: 2012-2017

PI: 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.



FP7-NMP

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/>

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.



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

PIs: Prof. 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.

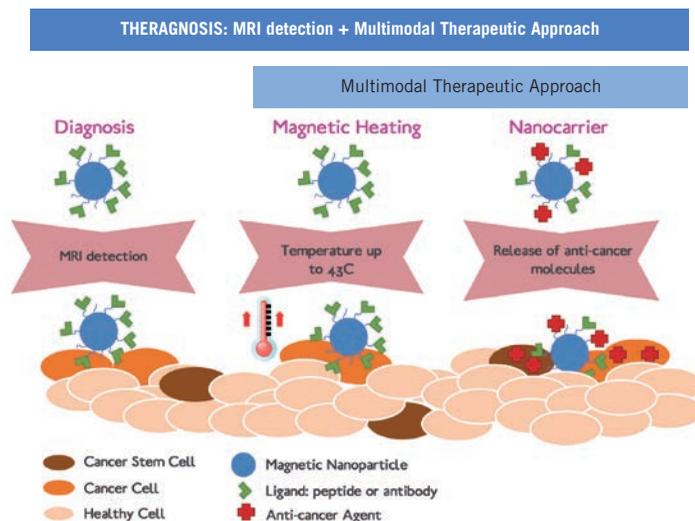


Figure 1: schematic representation of the MNP functionalities related to the theragnostic approach.

FP7-ENERGY

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

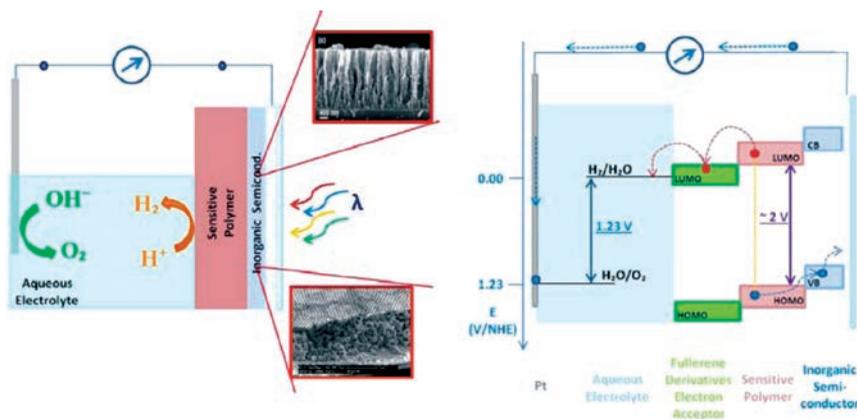
Duration: 2012-2015

PIs: Prof. 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.

Marie Curie Actions

SPINOGRAPH

Spintronics in graphene

Funding: FP7-PEOPLE-2013-ITN-n° 607904

Consortium of 9 European partners coordinated by the INL, Portugal

Duration: 2015-2017

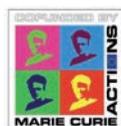
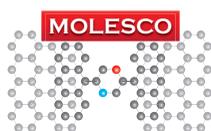
PI: Prof. Francisco Guinea

<http://www.spinograph.org/>

SPINOGRAPH is a Marie Curie Initial Training Network on "Spintronics in Graphene", bringing together 7 academic and 2 industrial partners to train 15 young researchers doing top class research projects. Spintronics stands for electronics based on the electron spin degree of freedom. The huge success of spintronics in metals, which started from the pioneering discovery of Giant Magnetoresistance (GMR), has revolutionized the mag-



netoelectronics industry. Exploration of spin effects in other types of materials is leading to an array of fascinating physical phenomena and holds the promise of future breakthroughs. The discovery of graphene, the first truly two dimensional crystal, together with the remarkable progress in the fabrication of graphene devices, have naturally led to the exploration of hybrid graphene/ferromagnetic devices to explore spintronics in graphene.



MOLESCO

MOLECULAR-SCALE ELECTRONICS: Concepts, Contacts and Stability

Funding: FP7-PEOPLE-2013-ITN-n° 606728

Consortium of 10 european partners coordinated by the University of Durham, UK

Duration: 2014-2017

IMDEA Reserach Team: Prof. Nazario Martín (PI) and Prof. Nicolas Agrait (PI)

<https://www.dur.ac.uk/chemistry/molesco/>

The MOLESCO network will create a unique training and research environment to develop a pool of young researchers capable of achieving breakthroughs aimed at realising the immense potential of molecular electronics. In part this will involve the major challenges of design and fabrication of molecular-scale devices. To deliver this step-change in capability, MOLESCO will coordinate the activities of internationally-leading scientists from six different countries. MOLESCO has secured the participation of nine private sector partners, including one of Europe's leading industrial electronics-research laboratories (IBM Research–Zurich) as a full partner. A highly-integrated approach to the experimental and theoretical aspects of molecular-scale electronics will deliver the fundamental knowledge and new fabrication strategies needed to underpin future nanotechnologies targeted for electronics applications. MOLESCO represents a highly interdisciplinary and intersectoral collaboration between teams with an extensive portfolio of skills, including molecular synthesis, fabrication of molecular junctions, imaging of molecular junctions with atomic resolution, measurements of charge transport, and electronic structure and transport calculations.

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

<http://pocaontas-network.eu/>

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 STABILlty 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 (PI)

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

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

Consequently, the first step was to build up and optimize our main research tools: microsecond pump-probe spectroscopy, photo-induced absorption spectroscopy and femtosecond spectroscopy. The set-up for microsecond pump-probe spectroscopy has now a



noise level in the 10^{-7} region, and is thus internationally competitive. Moreover, a set up for time resolved photovoltage has been built up, in order to benchmark electrical and optical information from the solar cells under study. One of our aims is to understand why oxygen reduces OSC's efficiency. Fig. 1 shows how the presence of oxygen reduces the extraction of charge carriers in OSCs.

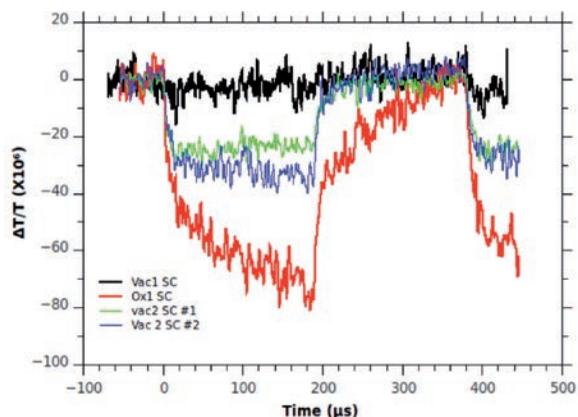


Fig.1. Optical detection of charge carriers in an organic solar cell under short circuit (SC) conditions via their induced absorption (negative differential transmission, $\Delta T/T$, at 980nm. A highly efficient pristine solar cell (black curve) does not accumulate charges at all, because of efficient extraction. After oxygen sorption (red curve), a strong charge accumulation is found after light on at 0 μ s, 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.



MEMOTUMCELLMACH

Metallo drugs to Modulate Tumour Cell Machinery

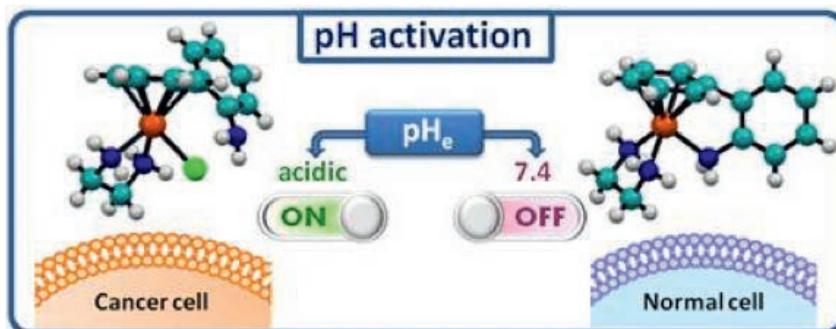
Funding: FP7-PEOPLE-2013-CIG no. 631396

Duration: 2015-2018

PI: Dr. Ana M. Pizarro

The past decade has seen substantial advances in our understanding of cancer molecular biology and the technologies available to study it, emphasising the importance of the multiple molecular mechanisms of carcinogenesis in cancer research. Effective single molecular targets therapies are generally not sufficient to elicit durable clinical responses and the development of drug resistance is an increasing problem. Consideration of only a single drug-target interaction *in vivo* has proven to be overly simplistic. The ultimate goal of this proposal is to generate multi-targeting metallo drugs whose

mechanism of action is understood and whose targets are identified. These metallo-medicines will exploit the extraordinary features of transition metal complexes, in particular the capability for *in tumour* activation, and the possibility of being loaded into nanocarriers, conferring control on the drug reactivity, and thus minimising undesired side effects, often responsible for drug failure. Our approach intends to modulate and deconvolute the technology behind the tumour cell machinery at the subcellular level, i.e., at the nanoscale



ImaginDNA

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

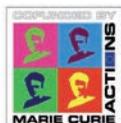
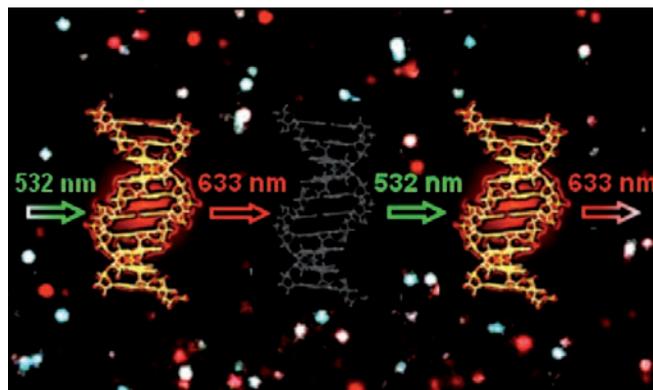
Funding: FP7-PEOPLE-2011-CIG n° 303620

Duration: 2013-2017

PI: 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”

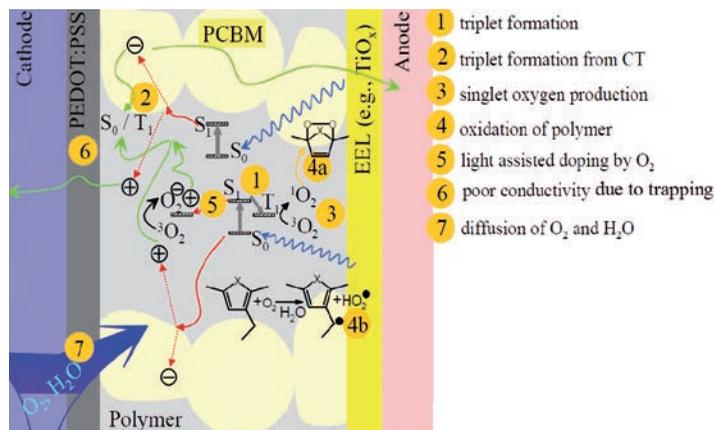
Funding: FP7-PEOPLE-2012-IEF n° 331795

Duration: 2013-2015

PI: 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.



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

PI: Dr. Ramsés V. Martínez



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.

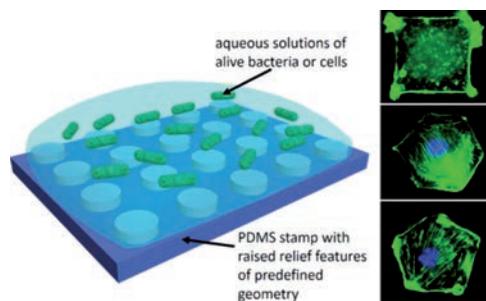


Figure 1. Left: Method for the patterning alive bacteria or cells using micro-contact printing. Right: Confocal microscope images showing the control on the shape of the printed cells. Each cell has a surface of approximately $900 \mu\text{m}^2$. Images obtained by fluorescence microscopy of cells confined 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).

3.5.1.4. European Science Foundation



XLIC

“XUV/X-ray light and fast ions for ultrafast chemistry”

Funding: European Science Foundation. CMST COST Action CM1204

Duration: 2013-2017

Chair of the Action: Prof. 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

RADIOMAG

Multifunctional Nanoparticles for Magnetic Hyperthermia and Indirect Radiation Therapy

Funding: European Science Foundation, TD Pilot COST Action TD1402

Duration: 2014 - 2018

Chair: Dr. Simo Spassov (Centre de Physique du Globe de l'Institut Royal Météorologique de Belgique)

Vice Chair: Dr. Daniel Ortega

http://www.cost.eu/COST_Actions/TDP/Actions/TD1402

In recent years, the emerging field of nanotechnology has paved its way into cancer treatment procedures with the use of nanoparticles for contrast media and therapeutic agents. The combination of conventional cancer therapies with nanotechnologies has shown to be promising in individual clinical studies and bears an enormous potential for the treatment individualisation tailored according to the patients needs.

This COST Action aims at teaming experienced scientists and young researchers from nanophysics, chemical sciences and medicine for improving the knowledge of combined cancer therapies. Particular attention will be paid to the increase of the radiotherapy efficiency and its combination with magnetic hyperthermia. These new findings, obtained under the coordination framework of this action, will result in a better dose optimisation confining cell damage to tumour regions only, under concurrent exploitation of sophisticated radio-surgical tools already available in hospitals. Furthermore, proper dissemination of scientific results to the broad public and possible stakeholders is another important concern of this action.

The improved knowledge resulting from the proposed coordinated, target-oriented interdisciplinary exchange will encourage industrial partners to produce a new generation of magnetic nanoparticles suitable for diagnosis, chemotherapy, radiotherapy and magnetic



hyperthermia. Promoting the application of combined cancer treatments will contribute to a better individualised treatment planning for cost-efficient cancer therapies covered by state health insurances.



NanoSpectroscopy

Funding: European Science Foundation. MPNS COST Action MP1302

Duration: 2013-2017

IMDEA Research Team: 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

3.5.1.5. Royal Society of Chemistry

Magnetocaloric effect in nanostructured materials

Funding: Royal Society of Chemistry (UK)

Duration: 2014-2015

PI: Dr. Daniel Ortega

Magnetocaloric (MC) and giant-magnetocaloric (GMC) materials, those showing a reversible temperature change in response to a changing magnetic field are key for the development of magnetic refrigeration at room temperature. This technology would reduce considerably the current consumption of electricity caused by refrigeration and air-conditioning. Scaling these down to the nanoscale opens up a new range of applications for MC and GMC materials: lighter and highly permeable MC materials for small devices or nanofluids for more efficient cooling systems for high-power-density devices. Furthermore, it has been envisioned that MC and GMC nanomaterials would contribute to cater the new demands of modern medicine, especially diagnostics and therapeutics. Besides exploring the MC effect at the nanoscale, this project is devoted to design MC and GMC nanomaterials for technological and medical applications.



3.5.1.6. Chinese Scholarship Council

Organic position sensitive photodetectors

Funding: Chinese Scholarship Council Call 2011

Duration: 2012-2016

PIs: Dr. Juan Cabanillas, Dr. Feng Luo, Dr. Miguel Ángel 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-González and M. Campoy-Quiles, *PCT/ES2011/070841*.

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



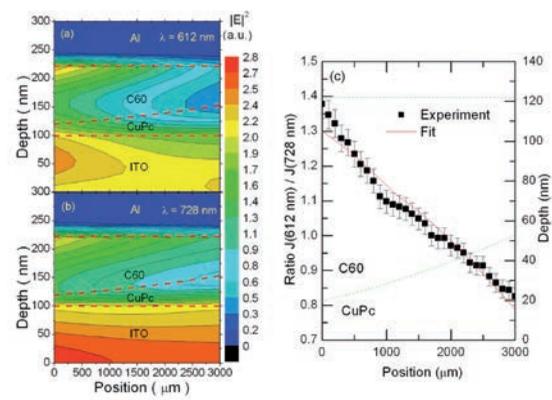


Figure. (Left) Optical modelling of the in-depth distribution of light across a multilayer photodetector. (Right) Dependence of photocurrent as a function of position.

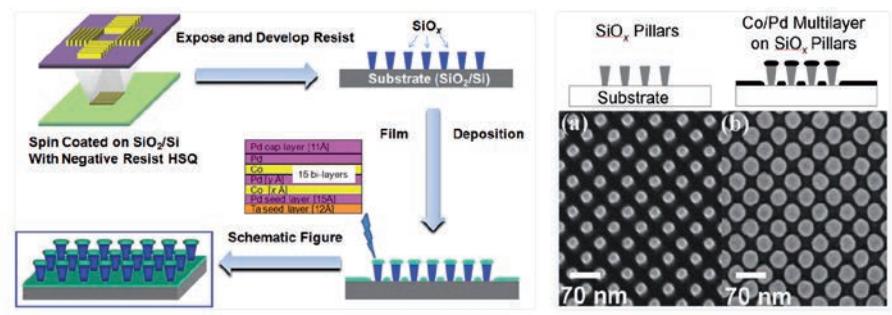


Multilevel magnetic recording in bit patterned media for areal densities above 5 Terabit-per-square-inch

Funding: Chinese Scholarship Council Call 2011
 Duration: 2012-2016
 PI: 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

3.5.2. National programmes

3.5.2.1. Ministerio de Economía y Competitividad

MULTICROM

“Highly Defined Supramolecular Multi-Chromophore Systems for Advanced Optoelectronics”

Funding: Ministerio de Economía y Competitividad. Programa Estatal de Investigación, Desarrollo e Innovación Orientada a los EXCELENCIA de la Sociedad 2014. CTQ2014-58801

Duration: 2015-2017

IMDEA Research Team: Dr. Johannes Gierschner (PI), Dr. Larry Lüer (PI) & Dr. Begoña Milián- Medina (Univ. Valencia)

Conjugated organic materials have become fascinating alternatives to traditional materials in light-energy and/or energy-information converter, due to their unique features. This concept is now taking the next crucial step, targeting supramolecular nanostructured strongly coupled multi-chromophore (two component) materials with unprecedented optical, electrical and/or magnetic effects by cooperative interaction. MultiCrom aims at an understanding of the optoelectronic function of such systems, relying on collaborations with academic and industrial partners from material science at IMDEA and abroad who are following different strategies for multi-chromophoric systems, as well as with (in-house) experts in thin film preparation and characterization and advanced x-ray techniques. All these strategies will be systematically explored by in-depth analysis of the optical and photophysical properties of the target systems through (polarized) steady-state and (fs to ms) time-resolved UV/Vis/NIR absorption and fluorescence techniques, and complemented by computational techniques. The strong interdisciplinary approach, together with the complementary expertise of the team and our state-of-the-art equipment is expected to yield well-defined design rules for complex conjugated multi-chromophoric materials for optoelectronic applications.



ACMENANOTOOLS

“Activatable Metallodrugs for New Nanoinspired Anticancer Tools”

Funding: Ministerio de Economía y Competitividad. Programa Estatal de Investigación, Desarrollo e Innovación Orientada a los Retos de la Sociedad 2014. CTQ2014-60100-R.

Duration: 2015-2017

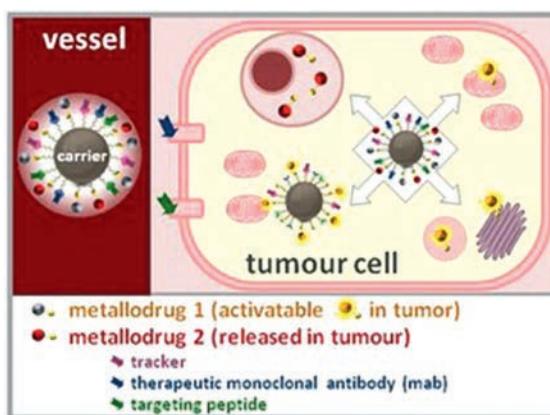
PI: Dr. Ana M. Pizarro

This project we produce new chemical entities – metalloorganic drugs, with biocatalytic activity in human cells. Aware of the challenge that is healthy-cell toxicity of current anticancer



drugs, we propose that these drugs are synthesised as prodrugs. We will take advantage of advanced metal coordination chemistry and organometallic chemistry principles to develop innovative ways of activating the drugs at the tumour site: (a) taking advantage of the physicochemical differences of cancerous tissues, from the tumour microenvironment to the cell nucleus; and (b) by phototriggered ligand substitution reactions. This will provide selectivity for cancerous tissues. The extraordinary complexity of carcinogenesis will be met by loading the metallodrugs onto nanocarriers bearing targeting and drug-modulating functionalizations.

The research programme is highly interdisciplinary bringing together chemistry, cell biology and physics in the search for truly innovative (nano)medicines that revolutionise the field of cancer research at the translational level.



miRGold

“Design and evaluation of therapeutic agents and sensors based on non-coding RNAs and nanostructures”

Funding: Ministerio de Economía y Competitividad. Programa Estatal de Investigación, Desarrollo e Innovación Orientada a los Retos de la Sociedad 2014. SAF2014-56763-R

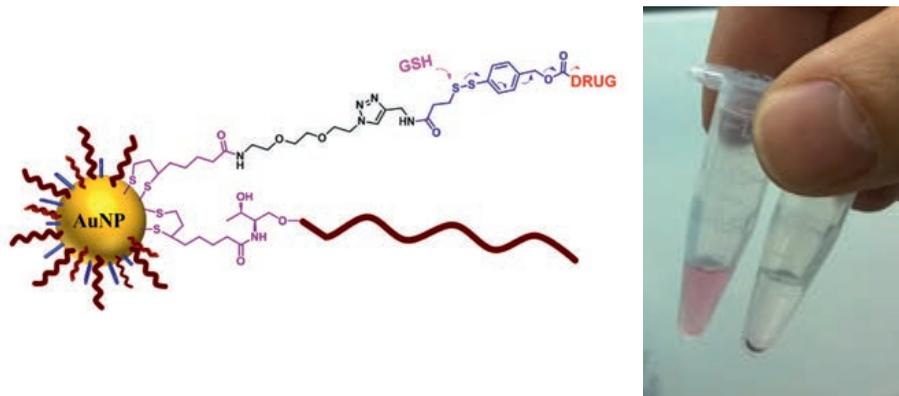
Duration: 2015-2017

PI: Dr. Álvaro Somoza

The aim of this project is to develop systems based on gold nanoparticles and oligonucleotides for the detection and treatment of Uveal Melanoma.

Gold nanoparticles functionalized with oligonucleotides present interesting properties for nanomedicine applications. For instance, these nanostructures can translocate easily into the cells and deliver chemotherapeutic drugs or nucleic acids. We plan to use this property to improve the delivery of the mTor inhibitor AZD8055 or siRNAs against genes and microRNAs involved in Uveal Melanoma.

Regarding the detection of this type of cancer, we plan to functionalize gold nanoparticles with oligonucleotides with the complementary sequence of selected microRNAs and fluorescent dyes, for the detection *in vivo*, and hydrophobic molecules, for the detection *ex vivo*. In the first case, the disease will be detected by fluorescence inside the cells, and in the second case, the aggregation of the gold nanoparticles will be used as read-out after the incubation of the functionalized nanostructures with RNA extracts.



MMM

“Machines and Materials based on Mechanically Interlocked Nanotubes”

Funding: Ministerio de Economía y Competitividad. Programa Estatal de Investigación, Desarrollo e Innovación Orientada a los EXCELENCIA de la Sociedad 2014. CTQ2014-58801

Duration: 2015-2017

PI: Dr. Emilio Pérez

Our group has recently described the synthesis of mechanically interlocked derivatives of single wall carbon nanotubes (MINTs). MINTs are rotaxane-type species where the single-wall nanotubes (SWNTs) act as threads, which are encapsulated by macrocycles formed around them through ring closing metathesis, following a “clipping” strategy. To ensure a template effect, we incorporated two exTTF units as recognition motifs for the SWNTs in the linear precursors to the macrocycles. The objectives of this project are:

1. To utilize other SWNT recognition motifs for the synthesis of MINTs.
2. To synthesize MINT-based materials for sensors, catalysis and photovoltaics, using a modular approach.
3. To investigate the controlled submolecular motion of the macrocycle(s) along the SWNT thread, making use of the dynamic nature of the mechanical bond.



The first objective will be tackled by maintaining the initial design for the macrocycle precursors, introducing variation in the SWNT recognition fragment only. In particular, we will focus our attention on pyrene, naphthalene and perylene diimides, and porphyrins. To synthesize a common building block for multifunctional materials, we will introduce alkyne or azide functionalities in the structure of the macrocycle precursors. To the properly functionalized MINT building block, we will “click” molecular hosts (for sensors), catalysts, or photoactive molecules (solar cells). Finally, to investigate the submolecular motion of the macrocycle(s) along the SWNT thread in MINTs, we will follow two different approaches to suspend the MINTs, which in turn imply different methods of controlling and visualizing the movement. Firstly, we will utilize surfaces patterned at the nanoscale, on which we will directly deposit the MINT materials through drop-casting. In this case, AFM will be the main tool to control and observe the motion. Alternatively, we will deposit the MINTs between two metallic electrodes, which will be constructed through standard nanofabrication techniques. In this case, differences in the I/V curves will be used both to provoke and monitor the submolecular motion. Whenever possible, we will also use SEM and/or AFM.



CHIROSPIN

“Highly Defined Supramolecular Multi-Chromophore Systems for Advanced Optoelectronics”

Funding: MINECO, CTQ2014-58801

Duration: 2015-2017

PI: Dr. Miguel Angel Niño

CHIROSPIN aims to develop, probe and study the fundamental properties of organic spintronic systems based on chirality, and to study the interplay between magnetic anisotropy and chiral effects for technological applications. In particular, within a multidisciplinary experimental approach which includes technical developments, the project will investigate the chiral induced spin selectivity (CISS) property presented by adsorbed layers of some molecules, in order to produce spintronic devices, i.e., sensors, magnetic memories and spin valves.

CHIROSPIN project is a collaboration between IMDEA Nanoscience and Alba Synchrotron bringing complementary expertises, in order to advance our understanding in a new multidisciplinary area, referred as Chiral Organic Spintronics. The research activity will cover different scientific issues, such as growth, electronic, magnetic, and transport characterization, for which it is necessary the combination of laboratory techniques and synchrotron radiation techniques. The production of highly polarized spin currents at room temperature is difficult in organic layers, but this limitation can be solved by using certain enantiomers of chiral molecules, as we have recently shown. When unpolarized electrons cross a thin film of a chiral layer, due to the CISS effect, there is a spin polarization with a definite anisotropy, parallel or perpendicular to the surface depending on the enantiomer type. In this project we study chiral organic-based spintronic systems, as a proof of principle, through the determination

of both electronic, magnetic, and magnetoresistive properties. The identification of the key parameters controlling the magnetic and transport properties are of fundamental importance in the final performance of practical technological applications, and this will pave the way for the development of advanced high efficient spin-polarized current organic-based devices.

LAPSEN

“Chemical Sensors Based on Dye-Doped Conjugated Polymer Laser Resonators”

Funding: Ministerio de Economía y Competitividad. Programa Estatal de Investigación, Desarrollo e Innovación Orientada a los Retos de la Sociedad 2014. MAT2014-57652-C2-1-R

Duration: 2015-2018

IMDEA Research Team: Dr. Juan Cabanillas-González (PI) and Dr. Isabel Rodríguez (PI)

In this project we aim at developing chemical sensors based on conjugated polymers (CPs) following a new approach to induce fluorescence transduction signals in the presence of specific analytes using a priori non sensitive CPs. The approach consist of doping CPs with optically-sensitive molecular dyes and make use of a potential Forster resonant energy transfer between both to translate the colorimetric response from the dye into the fluorescent response from the polymer in the presence of toxic gases and volatile organic compounds. Enhanced sensitivity will be subsequently achieved by processing responsive CP/dye blends into laser resonators upon nanostructuring the film surface. We aim at developing a novel strategy to circumvent complex molecular substitution required to achieve high resposivity in pristine CPs. We envisage a combined effort between two different institutions providing the necessary knowledge on photophysics, conjugated polymer photonics, nanostructuring, sensor fabrication and characterization.

ENMA

“Highly Defined Supramolecular Multi-Chromophore Systems for Advanced Optoelectronics”

Funding: Ministerio de Economía y Competitividad. Programa Estatal de Investigación, Desarrollo e Innovación Orientada a los Retos de la Sociedad 2014, CTQ2014-58801

Duration: 2015-2017

PI: Dr. Alberto Bollero

ENMA is a project leaded by the *Division of Permanent Magnets and Applications* at **IMDEA-Nanociencia** that aims at developing **rare earth-free permanent magnets** (PMs) as alternative to controversial and costly NdDyFeB magnets. **MnAl** is a promising choice due to the abundance of the constituent elements and potential magnetic properties. However, practical implementation of these magnets requires a proper understanding



and optimization of the magnetic properties with morphology and microstructure. Furthermore, **ENMA** will develop advanced processing routes based on **3D printing technology**.

Scientific and technological impacts of the project are manifested by participation of a long time experienced PMS-enterprise, **IMA S.L.**, in addition to a prominent research group in the field of new PMs: **Chemical Engineering Department at Northeastern University in Boston**.



GLIOMATHERAPY

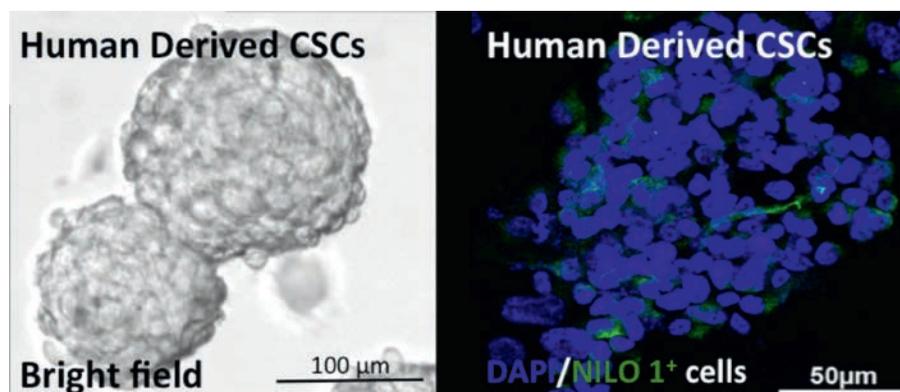
“Immunotherapy against high-grade brain tumour with monoclonal antibody”

Funding: Plan Estatal de Investigación Científica y Técnica y de Innovación 2013-2016. Ministerio de Economía y competitividad. (RTC-2015-3846-1)

Duration: 2015-2018

IMDEA Research Team: Dr. Ángel Ayuso Sacido (PI) and Dr. Aitziber López Cortajarena

Malignant gliomas are the most common primary brain tumours and account for the majority of cancers in the adult central nervous system, and the most aggressive and frequent (60%–70%) glioma subtype is glioblastoma multiforme (GBM). Current glioma treatments based on surgery, radiation, and chemotherapy show little success, with a median survival of only 14.6 months. One of the underlying reasons for this treatment failure is the presence of cancer stem cells (CSC) that initiate and maintain the tumour mass and are responsible of recurrences. Recently, we have demonstrated that Nilo1 (a monoclonal antibody) identify CSCs from human GBM samples. This antibody is also able to inhibit neurosphere proliferation *in vitro*. All together suggests that Nilo 1 might be useful to define new therapeutic approaches to fight human gliomas. With this project, IMDEA nanoscience, in collaboration with Althia Health SL, and the CSC’s lab at CIB-CSIC, aims to determine the role of Nilo 1 in human brain tumour diagnostic and treatment, by using both *in vitro* 3D CSCs cultures and *in vivo* mice xenotransplanted with human-derived CSCs models.



2DFlexotronics

“Two-dimensional flexible and transparent optoelectronics for photovoltaic applications”

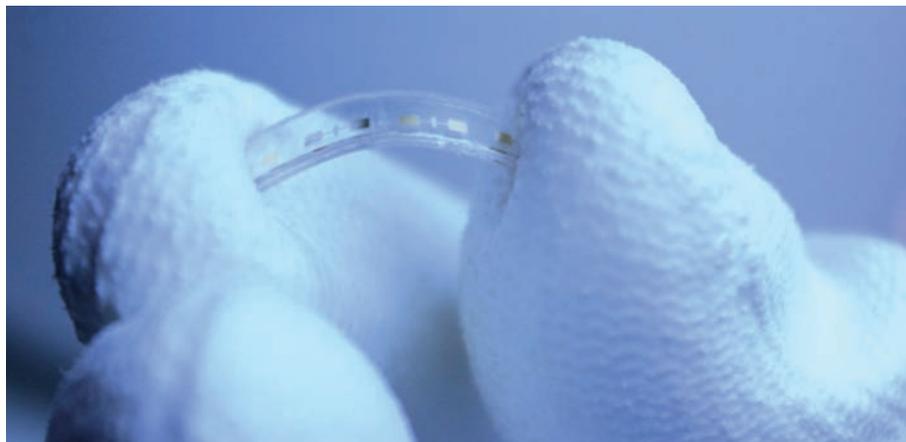


Funding: Plan Estatal de Investigación Científica y Técnica y de Innovación 2013-2016. Ministerio de Economía y competitividad. Proyectos de I+D+I para jóvenes investigadores sin vinculación. (MAT2014-58399-JIN)

Duration: 2015-2018

PI: Dr. Andrés Castellanos Gómez

The goal of this project is to demonstrate the feasibility of two-dimensional semiconductor materials for flexible optoelectronic applications where conventional semiconductors cannot be applied. The strong light-mater interaction of these materials will be exploited to fabricate devices that are not only flexible but also quasi-transparent without diminishing their efficiency. Amongst the fabricated optoelectronic devices, special attention will be given to socially and industrially relevant functionalities such as photodetectors (imaging systems) and solar cells (energy harvesting). This project constitutes the first steps towards the fabrication of flexible and transparent solar cells and photodetectors. These kind of devices will undoubtedly find applications in smart coatings or windows to harvest solar energy in places where conventional solar cells cannot be installed because of their rigidity or opacity. Therefore, this project deals with the societal challenge of achieving secure, clean and efficient energy described in the Horizon 2020 strategy.



Picture of a flexible and quasi-transparent solar cell fabricated with two-dimensional semiconductors.

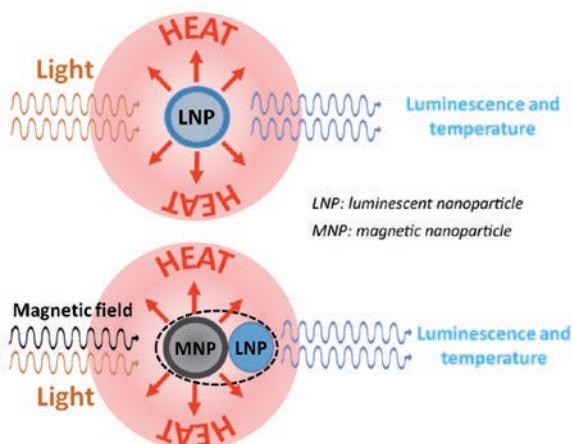
Multifunctional Nanostructures for Cancer Imaging and Controlled Thermotherapy

Funding: Ministerio de Economía y Competitividad. Programa Estatal de Investigación, Desarrollo e Innovación Orientada a los Retos de la Sociedad 2013. MAT2013-47395-C4-3-R

Duration: 2014-2017

IMDEA Research Team: Dr. Francisco Terán (PI) and Dr. Daniel Ortega (PI)

NANOTER is a multidisciplinary project aiming to develop novel multifunctional nanostructures for biomedical applications, mainly cancer therapy. NANOTER involves three research groups from UAM (coordinators), URV and iMdea, whose main goal is the synthesis and validation of novel nanostructures that combine: (i) remotely activated generation of local heat by IR light or AC magnetic fields, (ii) intratumoral temperature monitoring through luminescent probes, and (iii) medical imaging. It is precisely the combination of these features in a single platform where the originality of NANOTER lies upon. These multifunctional nanostructures are intended to increase the efficacy of thermal therapies against cancer by providing the means to control intratumoral heat exposure, which is one of the greatest challenges for using nanoparticle mediated hyperthermia in clinical settings.



G-quadruplex as a nanoheater-induced molecular switch demonstrated by optical tweezers

Funding: Ministerio de Economía y Competitividad. Programa Estatal de Fomento de la Investigación Científica y Técnica de Excelencia. Subprograma Estatal de Generación del Conocimiento. Proyectos “Explora Ciencia” 2013. MAT-49455-EXP

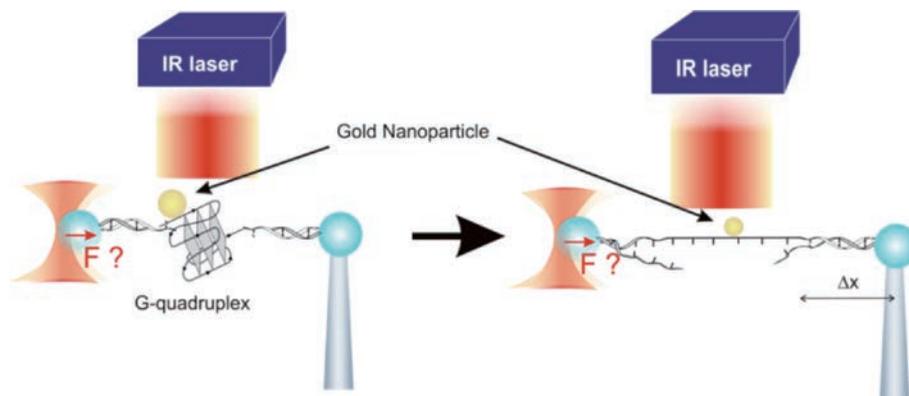
Duration: 2014-2015

PI: Dr. J. Ricardo Arias

G-quadruplexes are nucleic acid sequences rich in guanines (G) that form four-stranded structures. Control over the mechanics of folding and unfolding of the G-quadruplex structure has become an attractive goal in cancer research. There are several metallic complexes known to stabilize G-quadruplexes. They block the unfolding of the structure inhibiting the activity of telomerase.

We aim to use gold NPs as G-quadruplex folding/unfolding switches upon laser irradiation. We aim to demonstrate by using optical tweezers that we can control the conformation of a G-quadruplex by means of the heat released by a nanostructure. To test this prospect, we will attach a single gold NP to a (Pt-)G-quadruplex to attain a highly specific control on its folding state by using a laser beam. Then, we will use optical tweezers to hold a single G-quadruplex-NP construction to obtain a clear-cut detection of the folding/unfolding mechanical force signal.

Positive results will set the basis for the development of active nanoswitches that combine nucleic acids and absorptive NPs with unprecedented control by physical means. The proposed nanoactuators could be remotely controlled for therapeutic uses.



Central assay in TweezQuadSwitch: a G-quadruplex doped with a gold NP is illuminated in the infrared by a focused laser beam (left), exciting heat from the NP thus generating the mechanical unfolding of the nucleic acid structure (right) at a critical force F measured by the optical trap.

SUPERBIOL

Origin of life: generation prebiotic molecules in controlled chemical reactions on mineral surfaces

Funding: Ministerio de Economía y Competitividad. Programa Estatal de Fomento de la Investigación Científica y Técnica de Excelencia. Subprograma Estatal de Generación del Conocimiento. Proyectos “Explora Ciencia” 2013. MAT-49893-EXP

Duration: 2014-2015

PI: Dr. Miguel Ángel Niño



The sulfur-iron world is a hypothesis about the origin of life proposing that a pioneer organism, from which extant life was spawned, was generated from simple chemical reactions on the surfaces of iron sulfides mineral particles. Both these substrate particles and the reactive gases might have been produced in specific environments (such as thermal vents near volcanic craters). This project intends to analyse the feasibility of studying prebiotic chemical reactions by means of spectroscopic and desorption techniques; this approach allows analysing at the atomic scale, and under a broad range of pressures and temperatures, both intermediate adsorbed species and the products of the surmised prebiotic reactions. The central role of surfaces in this theory suggests that much could be gained by using the methodology and the techniques of Surface Science. This implies a radical departure from the experimental strategy used before (the conventional chemical reactors in which the surfaces were reacting in a liquid medium), using instead the methodology of research on heterogeneous catalysis.



PROBIOMAT

“Tailored protein biomaterials“

Funding: Ministerio de Economía y Competitividad. Subprograma de Proyectos de Investigación Fundamental No Orientada BIO. 2012-34835

Duration: 2013-2015

PI: 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.

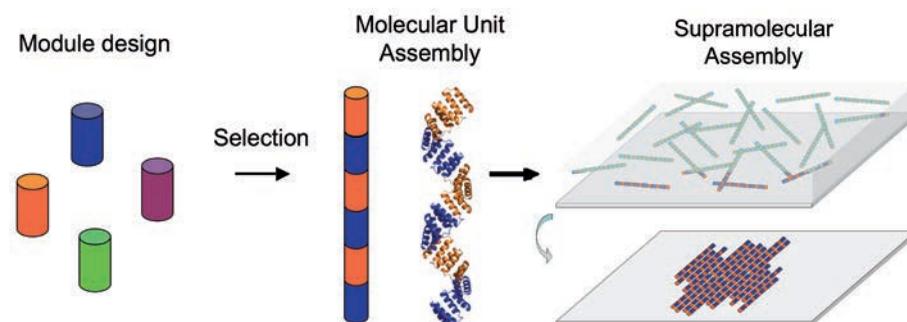


Fig 1. Schematic representation of bottom-up approach for engineering novel functional assemblies.

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.

ColQDMol

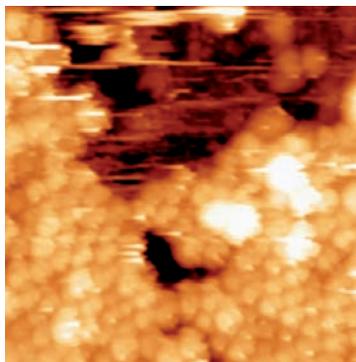
“Colloidal Semiconducting Quantum Dot Molecules Studied by Scanning Tunneling Spectroscopy and Tunneling Current-Induced Luminescence”

Funding: Ministerio de Economía y Competitividad. Subprograma de Proyectos de Investigación Fundamental No Orientada FIS2012-33011

Duration: 2013-2015

PI: 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



Funding: Ministerio de Economía y Competitividad. Subprograma de Proyectos de Investigación Fundamental No Orientada MAT2012-38810

Duration: 2013-2015

PI: Dr. Enrico Gnecco

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

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

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

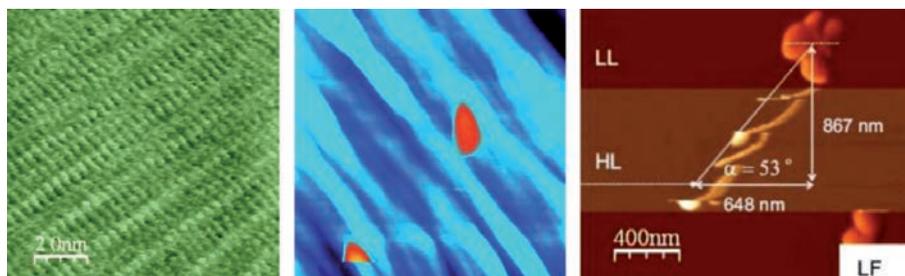


Fig. 1. Friction force map of CuPc molecules on dolomite (104) in water; Fig. 2. Detachment of a calcite island from a kutnahorite substrate; Fig. 3. AFM manipulation of Sb islands on a MoS₂ substrate.

DNA-COMPASS

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

Funding: Ministerio de Economía y Competitividad. Subprograma de Proyectos de Investigación Fundamental No Orientada. MAT2012-34487

Duration: 2013-2015

PI: 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

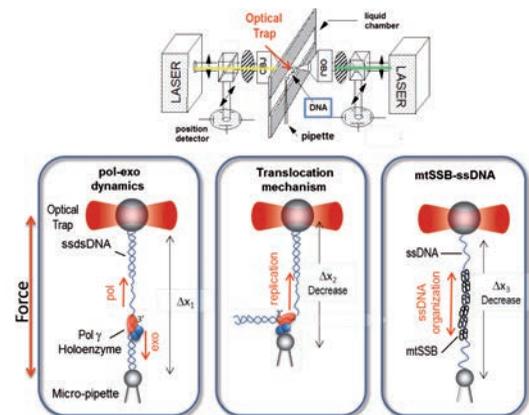
“Single molecule studies of the mitochondrial DNA replication dynamics”

Funding: Ministerio de Economía y Competitividad. Subprograma de Proyectos de Investigación Fundamental No Orientada. BFU2012-31825

Duration: 2013-2015

PI: 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.



NANOMADRID

Know Science Today Opens the Future's Doors



Funding: FECYT. FCT-12-4221.

Duration: 2014-2015

IMDEA Nanociencia: Dr. Félix Zamora, Daniel Granados, Álvaro Somoza, Teresa González
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.



Subprograma Estatal de Infraestructuras Científicas y Técnicas y de Equipamiento 2013

Funding: Ministerio de Economía y Competitividad. Programa Estatal de Fomento de la Investigación Científica y Técnica de Excelencia. FINA13-286

Duration: 2013-2015



Oficina de Proyectos Europeos MADRIMASD-IMDEA

Funding: Ministerio de Economía y Competitividad. Programa Estatal de Investigación, Desarrollo e Innovación Orientada a los Retos de la Sociedad 2013. Acciones de dinamización Europa Redes de Gestores. EUC2013-C-50806

Duration: 2014-2016

IMDEA Nanociencia as Participant

The project aims at strengthening the European Projects Office madrimasd-IMDEA, a network structure designed to support the participation of its members in European programs.

3.5.3. Regional programmes

NANOFRONTMAG

Nuevas fronteras del nanomagnetismo fundamental y aplicado.



Funding: Programas de Actividades de I+ D entre grupos de investigación de la Comunidad de Madrid. Convocatoria TECNOLOGÍAS 2013. S2013/MIT-2850

Duration: 2014-2017

Coordinator: Prof. Rodolfo Miranda (UAM & IMDEA Nanociencia)

IMDEA Research Team: Dr. Aitziber López Cortajarena (PI)

NANOFRONTMAG-CM is a research project framed in the R&D activities program of the Community of Madrid, cofinanced by the European Social Fund, whose development takes place between 2014 and 2018.

The project, entitled “New Frontiers of Fundamental and Applied Nanomagnetism” is coordinated by Professor Rodolfo Miranda and integrates ten recognized research groups plus two laboratories from the Madrid Network in a joint Research Program with a scientific proposal comprising the fabrication, characterization and applications of both organic (single molecules, molecular films) and inorganic (nanowires, nanoparticles) magnetic nanostructures. The Consortium has more than 60 scientists in the academic groups plus companies (ITP, Tecnatom, Ingeniería Magnética Aplicada) and hospitals (HM Hospitales) involved in the objectives proposed.

The Program has a strong component in the development of instruments built on the tradition of the participating institutions. Dr. Aitziber L. Cortajarena leads IMDEA Nanociencia group, and associated scientists Prof. José Luis Vicent, Prof. Nicolás Agraït, Prof. Fernando Martín and Prof. José L. Carrascosa lead some of the groups from UCM, UAM and CNB-CSIC.

PHOTOCARBON

Materiales avanzados de carbono para fotovoltaica molecular.



Funding: Programas de Actividades de I+ D entre grupos de investigación de la Comunidad de Madrid. Convocatoria TECNOLOGÍAS 2013. S2013/MIT-2841

Duration: 2014-2017

Coordinator: Prof. Nazario Martín (UCM & IMDEA Nanociencia)

IMDEA Research Team: Dr. Larry Luer (PI)

PHOTOCARBON is a research project entitled “Advanced carbon materials for molecular photovoltaics”. The project is framed in the R&D activities program of the Community of Madrid, cofinanced by the European Social Fund, whose development takes place between 2014 and 2018.

The aim of the project PHOTOCARBON is directed to the development of new advanced materials from different carbon nanoforms, namely fullerenes, endohedral fullerenes, fullerenes fragments, carbon nanotubes and graphene for their further study and use in the fabrication of organic photovoltaic devices. In this regard, in addition to the advanced characterization of these materials, their photophysical characterization in solution as well as in the solid state on the previously prepared devices.

The field of solar cells has undergone an outstanding progress outside of Spain and, specially in Europe. In this regard, our privileged geographical situation in terms of energy received from the Sun, should lead us to a higher development in this field in our country and in our Community of Madrid. The Program is coordinated by Prod. Nazario Martín and Dr. Larry Lüer leads IMDEA Nanociencia group.

MAD2D



MAD2D

Propiedades fundamentales y aplicaciones del grafeno y otros materiales bidimensionales.

Funding: Programas de Actividades de I+ D entre grupos de investigación de la Comunidad de Madrid. Convocatoria TECNOLOGÍAS 2013. S2013/MIT-3007

Duration: 2014-2017

Coordinator: ICMM-CSIC

IMDEA Research Team: Dr. Enrico Gnecco (PI), Prof. Francisco Guinea (PI), Dr. Daniel Granados(PI), Dr. Reinhold Wannemacher (PI)

MAD2D is a research project framed in the R&D activities program of the Community of Madrid, cofinanced by the European Social Fund, whose development takes place between 2014 and 2018.

The properties of graphene and other bidimensional materials, with on the development of devices and the storage and generation of energy.

The objectives are: i) Fundamental properties of graphene and other bidimensional compounds, ii) Synthesis and growth methods, iii) Functionalization, and iv) Energy storage and generation processes.

The proposal is to be carried out by a team from five public institutions, CSIC, IMDEA Nanociencia, IMDEA Materiales, IMDEA Energía and Universidad Autónoma de Madrid,

as well as research laboratories of the companies AIRBUS, REPSOL, BRUKER, Nanoinnova, Albufera and Airnova. The background of the teams involved range from basic research to applied development.

It is expected that the proposal will lead to advances in the understanding of the properties of graphene and other two dimensional compounds, and to developments of industrial interest in the design of sensors and in energy related applications.

3.5.4. Foundation programmes

BBVA

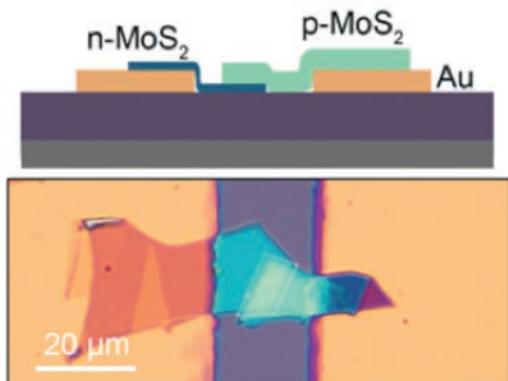
“Ultrathin semiconductors: towards flexible optoelectronics”

Funding: Fundación BBVA: Ayudas a Investigadores, Innovadores y Creadores Culturales

Duration: 2015-2016

PI: Dr. Andres Castellanos-Gómez

The aim of this project is to combine two of the most attractive properties of two-dimensional semiconductors: their extraordinary flexibility and remarkable optoelectronic properties. To this end optoelectronic devices will be manufactured by transferring these atomically thin semiconductors onto flexible substrates. Special attention to the case of flexible solar cells will be given because of its potential social impact in the energetic societal problem and to photodetectors because of its industrial interest in imaging systems (especially night vision systems). The performance of these new optoelectronic devices will be characterized for different levels of deformation, to evaluate its potential in flexible electronics applications. The results of this project will constitute a first step towards designing new transparent and flexible optoelectronic devices.



Optical image of an ultrathin solar cell fabricated by deterministic placement of 2D semiconductors: one n-type and another p-type to form a PN junction.

BBVA

Funding: Asociación Española Contra el Cáncer (AECC)

Duration: 2014-2017

PI: Dr. Álvaro Somoza

One of the most significant applications of nanotechnology is on the detection and treatment of diseases. This area of research is known as nanomedicine and aims to overcome the limitations of the current approaches using different nanomaterials. In this regard, one of the projects currently developed within the Nanomedicine program at IMDEA Nanociencia is focused on Uveal Melanoma. This project has been funded by the *Asociación Española Contra el Cáncer* and seeks novel strategies for the detection and treatment of this disease using gold nanoparticles and oligonucleotides as key elements, which are combined to obtain spherical nucleic acid nanoparticle conjugates.

Uveal Melanoma is one of most common tumors of intraocular malignancies. In 90% of the cases, UM is generated due to a single point mutation of GNAQ gene. Currently, the diagnosis of this disease is based on morphological changes of medium-large sized lesions, which are prone to be disseminated to other organs. What is more, the treatment of this metastatic tumor is for now ineffective. Therefore, the development of systems allowing an early detection and treatments of UMs could improve greatly the survival of the patients.

Gold nanoparticles have been proved excellent nanomaterials for biomedical applications thanks to their biocompatibility and ease of modification. Particularly, they can be loaded with different bioactive molecules and delivered to tumoral areas using specific targeting molecules, or used as sensors due to their unique optical properties.

Oligonucleotides have multiple applications in biomedicine; however they are mainly limited to *in vitro* assays, due to their poor stability and biodistribution *in vivo*, particularly RNA derivatives such as siRNAs. These nucleic acids are able to inhibit the expression of genes and we aim to treat Uveal Melanoma by suppressing those genes involved in the disease.

Spherical nucleic acid nanoparticle conjugates (densely oligonucleotide functionalized AuNPs), are nanostructures that present remarkable properties for biomedical applications such as high colloidal stability, biocompatibility, excellent cellular uptake and stability against nuclease degradation. These properties make them ideal systems to develop biosensors as well as delivery systems of drugs and nucleic acids.

Detection of Uveal Melanoma

The sensors of the disease will be based on spherical nucleic acid nanoparticles conjugates containing molecular beacons, which bear a fluorescent dye (Figure 1). The

particle will be able to reach the cytoplasm and release the molecular beacons, which will interact with nucleic acids associated with the disease, such as mutated mRNA or microRNAs. Upon this interaction the fluorescence will be significantly increased allowing the detection of Uveal Melanoma.

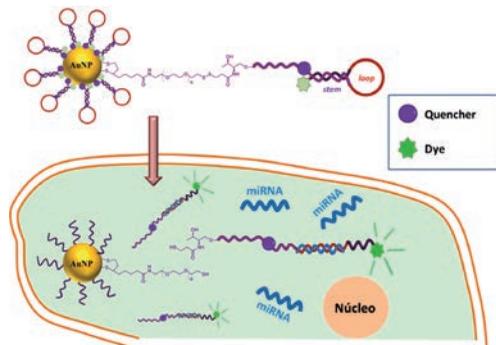


Figure 1. Detection of miRNAs using gold nanoparticles modified with molecular beacons.

Treatment of Uveal Melanoma

In the case of the treatment we will use spherical nucleic acid nanoparticles conjugates to deliver into the cells nucleic acids (siRNAs and microRNAs) that regulate the expression of genes involved in Uveal Melanoma (Figure 2). We will use chemical modifications developed by our group to improve the stability of nucleic acids and their activity.

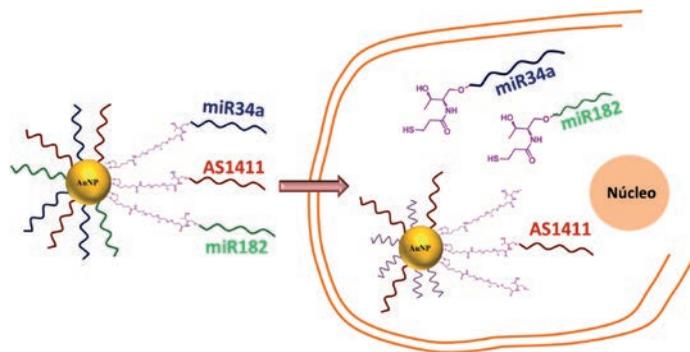


Figure2. Inhibition of microRNAs related with Uveal Melanoma using gold nanoparticles modified with nucleic acids.

3.5.5. Industrial Projects

SONAR

Director: Rodolfo Miranda & Bonifacio Vega

Management team: Mark Davies

Scientific team: Juan Cabanillas, Julio Camarero, Juan Luis Delgado, David Écija, Enrico Gnecco, Daniel Granados, Roberto Guzmán (IMDEA Materials), Beatriz Hernández, Larry Luer, Nazario Martín, Rodolfo Miranda, Roberto Otero, Jesús Palma (IMDEA Energy), Emilio Pérez, Isabel Rodríguez, Gorka Salas, Álvaro Somoza, Reinhold Wannemacher, Félix Zamora.

The first stage of the SONAR project (Strategic Opportunities of Nanotechnology Applications in Repsol) was completed in February 2015 with a closing session held at the Repsol Technology Research Centre (Móstoles, Madrid). A stimulating series of talks given by both IMDEA and Repsol scientists summarised the findings of the project reinforcing the importance of nanotechnology research for the Oil & Gas industry.

The initiative was financed by Repsol and can be considered a milestone in public-private collaborations. A joint team of more than 45 researchers from IMDEA and Repsol worked together to complete a strategic roadmap of nanotechnology applications in the energy sector. Repsol provided more than 65 current technological challenges, grouped into 6 areas of application. Joint workshops were organised to discuss the challenges and IMDEA proposed a series of nanotechnology solutions (more than 168 in total). These solutions were then filtered by the scientists to provide 95 opportuni-

ties producing the structure for a technology roadmap. Research tracks were then plotted onto the roadmap, providing a guide for navigating possible nanotechnology applications both in the short, medium and long term.

This technology prospecting exercise and the resulting internal roadmap has helped Repsol to define and implement a strategic framework in order to exploit the opportunities that nanotechnology can offer within the energy sector. Already as a result of this collaboration, Repsol and IMDEA Nanoscience have initiated several research projects, the first of which has recently successfully completed its first stage, (FREENOX, see below).



Figure 1: The closing session of SÓNAR (18th February 2015, at CTR Repsol).

Neel Brown (Repsol)

2015-2016

FREENOX (Repsol)

Directors: Rodolfo Miranda & Roberto Otero
Management team: Bonifacio Vega, Mark Davies

Scientific team: Rodolfo Miranda, Roberto Otero, David Écija, Daniel Granados, Manuel Rodríguez, Miguel Ángel Niño, Paolo Perna, Fernando Ajejas, Santiago Casado, Enrico Gnecco, Rubén Guerrero.

Laboratories: Epitaxial Growth Laboratory (B35), Centre for Nanofabrication (Z03), Atomic Force Microscopy (B17).

Reduction of NO_x emissions is one of the biggest challenges being faced by car manufacturers today, with tough emission regulations being enforced worldwide. Recently, this has become even more relevant with the emissions scandals that have hit some of the world's leading car manufacturers. Existing technologies available for the post-treatment of NO_x emissions may not meet the more stringent requirements of future targets and as such investigation into new technologies remains a priority. The SONAR project identified a number of opportunities for the application of nanotechnology in the reduction of NO_x emissions.

FREENOX was a proof of concept project proposed by IMDEA Nanoscience, work started in February 2015 and was completed in October 2015. The task involved scientists from both the epitaxial growth laboratory and the centre of nanofabrication working together to design and construct a working catalytic device.

A joint IP-management strategy has been implemented to help protect both future and current intellectual property.

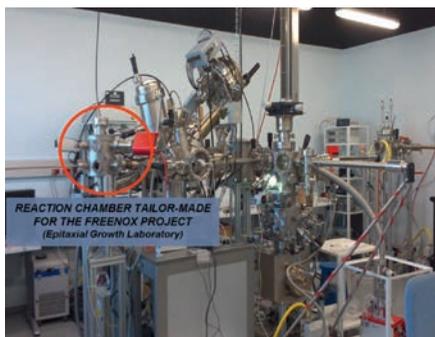


Figure 3: FREENOX reaction chamber.

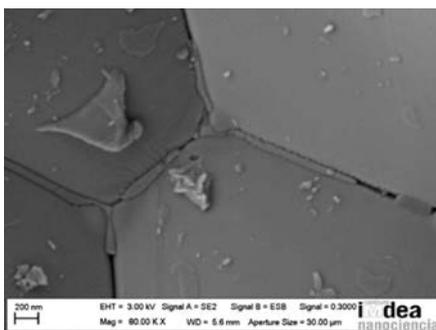
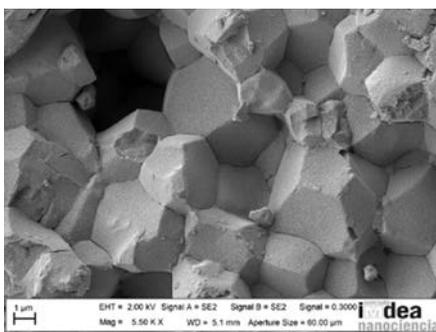


Figure 4: SEM images of the surface of devices prepared in the FREENOX project.

NEFROSENSE (Laboratorios Rubió)

Renal Failure Predictor test based in RNA detection in Colaboration with Nefrology and Reserach Departments at Hospital Ramón y Cajal.

- Fase 1: Jun – Oct 2014.
- Fase 2: Nov 2014 to July 2015.

Nano4water (Abengoa)

Management team: Bonifacio Vega

Principal scientist: Félix Zamora

A collaborative research project between IMDEA Nanociencia and Abengoa Research, led by Dr. Félix Zamora focused on the search for novel materials with potential application for water treatment. The objective was the preparation of porous polymeric materials based on the selection of inexpensive and industrially available molecular precursors, using simple synthetic procedures, with the aim to facilitate industrial scale up. The materials consist of bidimensional polymers with structural order, known as covalent organic frameworks (COFs), these have cavities in the range of 0.5-5 nm and show large surface areas. They are pre-designed to enable capture of metal ions and/or molecules in their cavities, therefore allowing their potential use as water

decontaminants. The initial results are very promising for treatment of water, capture of contaminants and their detection. Two patents have already been presented for evaluation. Additional potential applications for gas separation and storage or, as electrical energy storage technologies are also currently under evaluation.

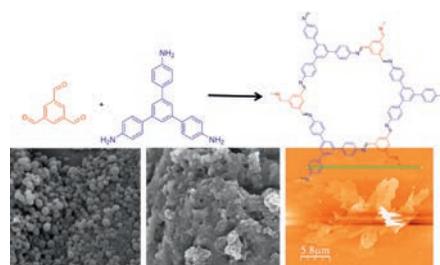


Figure 5: Schematic representation of a typical reaction to form a COF (top). Selected images of a COF showing different morphologies (bottom).

3.6. Fellowships and Internships

3.6.1. Fellowships

7FP Marie Curie Action. Amarout II

Incoming Fellowships

Call 2014

Dr. Ana Pizarro
Dr. David Ecija
Dr. Daniel Cano
Dr. Ruben Guerrero
Dr. Alberto Rodriguez Pulido
Dr. Jose Santos
Dr. Santanu Bhattacharyya
Dr. Dr. Paramjyothi C. Nandajan
Dr. Ruben Alvarez-Asencio

Call 2013

Dr. Daniel Ortega

Reintegration Fellowships

Call 2014

Dr. Agustin Molina

Call 2012

Dr. Isabel Rodriguez



Spanish Ministry of Science and Innovation

Ramon y Cajal Programme

Call 2013

Dr. David Ecija, Dr. Luo Feng, Dr. Daniel Granados,
Dr. Ana Pizarro

Call 2011

Dr. Cristina Flors, Dr. Begona Sot, Dr. Francisco Teran

Formación Posdoctoral Programme

Call 2013

Dr. Eva Céspedes

Technical Support Specialist Programme

Call 2013

Rebeca Amaro

Programa de Ayudas para la Promoción de Empleo Joven e implantación de la Garantía Juvenil en I+D+i

Call 2015

Sergio de las Heras
Noelia Lopez
Diego Ruiz

Spanish Ministry of Education

FPU Programme. Predoctoral Grant

Call 2013

Leyre de Juan

Call 2011

Macarena Calero

Basque Government

Department for Education, Language Policy and Culture o PREDOC Programme. Predoctoral Grant

Call 2013

Sara Hernandez

Chinese Scholarship Council

Call 2015

Chen Sun *Femtosecond time-resolved absorption and emission spectroscopy in self-threaded polythiophenes.* Four years PhD fellowship

Call 2014

Guilin Liu. *Photophysical investigations on single organic heterojunction interfaces".* Two years secondment PhD fellowship. Jiangnan University, China

Qi Zhang *Optical gain properties of conjugated polymer blends.* One year secondment PhD fellowship. Nanjing University of Posts and Telecommunications, China

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



Visiting students

Doctorate students

Diana Figueroa del Valle. Four months secondment. ESR POCAONTAS. Fondazione Istituto Italiano Di Tecnologia, Milano, Italy Supervisor: L. Luer

Rim Milad. Five months secondment. Université de Carthage, La Marsa, Tunisia Supervisor: J. Gierschner

Master students

Benedikt Dänekamp

Humboldt-Universität zu Berlin, Germany
October 2014-December 2015
Supervisor: J. Gierschner

Emelyne Pacull

University of Grenoble, France
April 2015-July 2015
Supervisor: A. López Cortajarena

Rameesha Mangattu Parambil

MES Ponnani College, Kerala, India
April 2015-July 2014
Supervisor: J. Gierschner

Aldo Martinez Banderas

King Abdullah University of Science and Technology, Thuwal Jeddah, Arabia Saudi
June 2015-July 2015
Supervisor: A. López Cortajarena

Mikio Shimasaki

Chiba University, Japan
October 2015-December 2015
Supervisor: A. Vázquez de Parga

High school students

Comunidad de Madrid Program for training stays in companies (ESO + Empresa Program)

Candelas Gross

(Colegio Alemán Madrid) 2 weeks in May 2015
Supervisor Dr. F.J. Terán

3.7. Academic Activities

3.7.1. Theses

Universidad Autónoma de Madrid

27/03/2015

Design and synthesis of new formulations of photosensitizers based on ruthenium, zinc and silicon phthalocyanines and conjugation with "bio" compatible nanoparticles for photodynamic therapy

Student: Francesca Setaro

Supervisors: T. Torres, Andres de la Escosura y Uwe Hahn

19/06/2015

Novel Single-Molecule Magnets and Photosensitizers for Molecular Photovoltaics Based on Customized Phthalocyanines

Student: Carolina Ruiz Ganivet

Supervisors: T. Torres Cebada y Gema de la Torre Ponce

27/10/2015

Tracing degradation effects in organic solar cells

Student: Safakath Karuthedath, Optical spectroscopy group, IMDEA Nanociencia

Supervisor: Larry Luer

18/11/2015

Scanning Tunneling Spectroscopy of Adsorbed Magnetic Molecules

Student: Siya Sherif

Supervisors: Nicolas Agrait

02/11/2015

Photosensitizers based on Ruthenium-Bipyridyl Complexes and Porphyrins for Dye-Sensitized Solar Cells

Student: María Médel González

Supervisors: T. Torres Cebada y Maxence Urbani

11/12/2015

Synthesis of fullerene-based phthalocyanine and subphthalocyanine hybrids and their electron transfer reactivity

Student: Olga Trukhina

Supervisors: G. Bottari and T. Torres

11/12/2015

Caracterización de nanopartículas magnéticas en cultivos celulares para sus aplicaciones biomédicas

Student: Macarena Calero Calero

Supervisor: A. Villanueva

Universidad Complutense de Madrid

18/12/2015

Efectos mesoscópicos y longitudes características en sistemas superconductores.

Student Javier Del Valle

Supervisors: E. M. Gonzalez, J. L. Vicent

3.7.2. Master Thesis

Design and production of hybrid functional nanostructures: gold nanoclusters stabilized by Consensus Tetratricopeptide Repeat proteins

Student: Emelyne Pacull (University of Grenoble, France)

Supervisor: Aitziber L. Cortajarena

2014-2015 successfully defended: 12.06.2015

Exciton Emission in Single Crystals of Conjugated Materials

Student: Rameesha Mangattu Parambil (MES Ponnani College, Kerala, India)

Supervisor: J. Gierschner

2014-2015 successfully defended: 15.09.2015

Synthesis and characterization of near infrared emitting Ag₂S nanoparticles

Student: Diego Ruiz Gómez (Universidad Autónoma de Madrid, Spain)

Supervisors: Beatriz H. Juárez

2014-2015 successfully defended: 18.09.2015

Multifunctional nanoparticles for selective cancer therapies: towards a model for rational design of selectivity

Student: Jael Fernández Cadenas (Universidad Autónoma de Madrid, Spain)

Supervisor: Aitziber L. Cortajarena

2014-2015 successfully defended: 25.09.2015

Solid-state photophysical properties of a series of gradual fluorinated ladder-type quaterphenyls

Student: Benedikt Dänekamp (Humboldt-Universität zu Berlin, Germany)

Supervisor: J. Gierschner

2014-2015 successfully defended: 23.12.2015

3.8. Participation in Courses, Seminars and Conferences

12.-14.01.2015

Visiting Professorship, Univ. Mons, Belgium

Photophysics of Conjugated Organic Materials,
J. Gierschner

26.-30.01.2015

COST Training School on Organic Semiconductors - from Photophysics to Applications, IMDEA Nanoscience, Spain

1: Excited States of Conjugated Organic

J. Gierschner

2: Practical Aspects of Optical Spectroscopy: UV/Vis Absorption & Fluorescence

J. Gierschner

02.02.2015

XVI Escuela Nacional Materiales Moleculares Santa Pola, Alicante, Spain

Ftalocianinas y Materiales Moleculares

T. Torres

12.02.2015

Department of Organic and Macromolecular Chemistry, Ghent University, Gent, Belgium

Subphthalocyanines: Singular aromatic non-planar molecules

T. Torres

Diseño racional de materiales bidimensionales

F. Zamora

19.02.2015

CNR, Bolonia, Italia

Designing 2D-Materials from MOFs and COFs
F. Zamora

seminars
courses and
conferences

19.05.2015

Visiting Professorship, Univ. Mons, Belgium*Photophysics of Conjugated Organic Materials*

J. Gierschner

20.05.2015

University of Mons, Belgium*Future Lighting: Chances & Challenges of OLEDs*

J. Gierschner

23.05.2015

Universidad Complutense de Madrid. Erasmus Mundus en Molecular nano-and bio-photonics for telecommunications and biotechnologies (MONA-BIPHOT)

Measuring Electrical Conductivity at the Molecular Level (3 lectures)

F. Zamora

28.05.2015

Argonne-Northwestern Solar Energy Research (ANSER) Center, Evanston, IL, USA

Subphthalocyanines: Singular aromatic non-planar molecules

T. Torres

30.06.2015

Instituto Tecnológico de Química y Materiales "Álvaro Alonso Barba", Universidad Carlos III de Madrid, Madrid, Spain

Magnetic nanoparticles for biomedical applications

G. Salas

15.07.2015

Dep. of Chemistry, University of Pau, France*Low Bandgap Polymers MO and Excited State Design*

J. Gierschner

30.07.2015

Institut Químic de Sarrià (IQS)-Universitat Ramon Llull, Barcelona, Spain

Subphthalocyanines: Singular aromatic non-planar molecules

T. Torres

14-19.08.2015

Summer School on Nanostructured Materials. University Helsinki, Finland*2D-Materials (3 lectures of a 1h each)*

F. Zamora

11.09.2015

Mini-symposium, dans le cadre des conférences de l'Ecole Doctorale Sciences Chimiques, à l'université de Strasbourg "Design and Synthesis of π -Conjugated Functional Systems", Salle de Conférence d'ISIS Strasbourg, France

Subphthalocyanines: Singular aromatic non-planar molecules

T. Torres

14.09.2015

Université de Strasbourg, Strasbourg, France

Phthalocyanines: old dyes, new molecular materials

T. Torres

15.09.2015

Université de Strasbourg, Auditorium - IPCMS Strasbourg, France

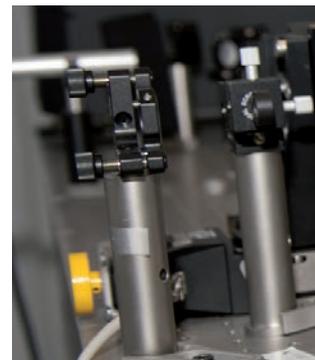
Phthalocyanines for Molecular Photovoltaics

T. Torres

22.09.2015

Xi'an Jiao Tong University, Xi'an, China*Magnetoplasmonic properties of Au/Co/Au nanoring based structures by hole mask colloidal lithography*

Feng Luo





23.09.2015

Xi'an Jiao Tong University, Xi'an, China

Nomagnets for future ultrahigh density magnetic recording media

Feng Luo

24.09.2015

Tsinghua University, Beijing, China

Nanotribology, Surface Interactions and Characterizations: An AFM Study

R. Alvarez-Asencio

25.09.2015

CNIC, Madrid, Spain*Cell Instructive Patterning*

I. Rodriguez

25.09.2015

IMDEA Nanociencia, Madrid, Spain

Microcal's user day: Microcalorimetría ITC/DSC para aplicaciones en ciencias de la vida

Sara H. Mejías

26.09.2015

Chemistry Department, Tarbiat Modares University .Tehran, Iran

Phthalocyanines: old dyes, new molecular materials

T. Torres

10.10.2015

Universidad Autónoma de Madrid, Madrid, Spain

Nanopartículas y Oligonucleótidos en Nanomedicina

A. Somoza

19.10.2015

ICMAB, Barcelona, Spain*Future Lighting: Chances & Challenges of OLEDs*

J. Gierschner

24.10.2015

Universidad Autónoma de Madrid, Madrid, Spain

DNA in Nanoscience

A. Somoza

17. & 19.11.2015

Visiting Researcher, Seoul National University, South Korea

Photophysics of Conjugated Organic Materials (tutorial)

J. Gierschner

15.12.2015

Universidad Complutense de Madrid. Talk in the frame of the course "Materiales Orgánicos y Nanociencia"

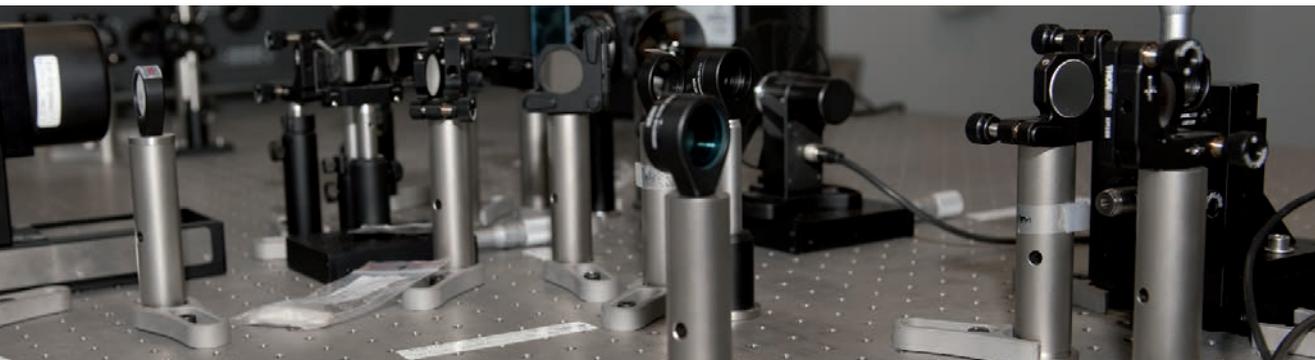
Nanopartículas semiconductoras

Beatriz H. Juárez

18.12.2015

Soft and Polymeric Matter Group, Instituto de Estructura de la Materia IEM-CSIC - Madrid*Surface Nanoimprinting of Functional Textures*

I. Rodriguez



3.9. Honors

February 2015

Dr. Emilio Pérez

Miguel Catalán 2013 young researcher prize.
www.madrid.org



March 2015

Prof. Nazario Martín

President of the Confederation of Scientific Societies Spain (COSCE)
http://elpais.com/elpais/2015/03/31/ciencia/1427829412_957047.html



June 2015

Irene Gutiérrez Pérez

Congreso de la Sociedad de Biofísica Española, Granada, Spain.

Prize at the best oral talk (poster format)

<http://www.sbe.es/granada2015/>

July 2015

J.L. Carrascosa

Elected Member of the Executive Committee of EBSA (European Biophysical Societies Association)

<http://ebsa.org/portal/>

November 2015

Dr. Félix Zamora

Research Excellence Award BASF of the Spanish Royal Society of Chemistry

<http://rseq.org/blog/generales/item/894-rese%C3%B1a-premios-rseq-2015>

honors

3.10. Scientific Outreach Activities

Talks

22.04.2015

The Nobel Prize in Chemistry 2014: what is a nanoscope?

Instituto de Química Orgánica General (CSIC), Madrid
C. Flors

28.05.2015

Nanotecnología aplicada a la Medicina

Asociación Española de Gerencia de Riesgos y Seguros (AGERS, Madrid)
J.R. Arias-Gonzalez

28.05.2015

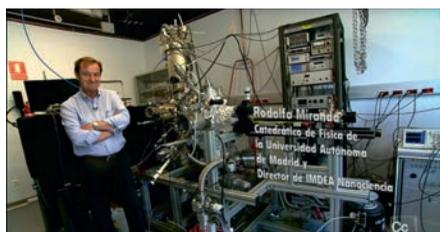
Química, microscopios e intuición (femenina)

Facultad de Química, Universidad Complutense de Madrid
C. Flors

14.10.2015

Nanopartículas. Una introducción

Oficina Española de Patentes y Marcas, Madrid, Spain
G. Salas



Dissemination Articles

Jun 11 2015

Futuro nanotecnológico y pinzas ópticas

Fernando Cerrón
<http://www.biotekis.es/2015/06/11/futura-nanotecnologico-y-pinzas-opticas/>

January 2015

Web Sociedad Española de Bioquímica y Biología Molecular

Especial Premio Nobel de Química 2014: *El nanoscopio*, Sociedad Española de Bioquímica y Biología Molecular (SEBBM). Includes interview.
C. Flors
<http://www.sebbm.es/web/es/divulgacion/acercate-nuestros-cientificos/281-cristina-flors-especial-premio-nobel-enero-2015-premio-nobel-de-quimica-2014-el-nanoscopio>

February 2015

Química y Sociedad

Mention in an article by Eugenia Angulo after interview: *"El síndrome de Estocolmo – El Premio Nobel como espejo de la investigación química de excelencia"*, Eugenia Angulo.
C. Flors
<http://www.quimicaysociedad.org/2015/02/23/el-sindrome-de-estocolmo-el-premio-nobel-como-espejo-de-la-investigacion-quimica-de-excelencia/>

December 2015

Boletín Sociedad Española Biofísica

Genetics and Biophysics

B. Ibarra

<http://biofisica.info/articles-4-2/genetics-and-biophysics/>

Media

8.01.2015

Radio Nacional de España (RNE) Programa "El canto del Grillo"

Ser científico en España

Beatriz H. Juárez

http://mvod1.akcdn.rtve.es/resources/TE_SCAGRVA/mp3/1/6/1420791767561.mp3

18.02.2015

El Progreso de Lugo (newspaper)

Dr. Juan Cabanillas interview

http://www.nanociencia.imdea.org/sites/default/files/pdf/press-releases/2015/juan_cabanillas-el_progreso.pdf



28.04.2015

El Correo Gallego (newspaper)

Dr. Teresa González interview

<http://www.elcorreogallego.es/galicia/ecg/teresa-gonzalez-un-plazo-no-muy-lejano-avances-nanociencia-estaran-vida-cotidiana/idEdicion-2015-04-18/idNoticia-926886/>



May 2015

Positive solutions to Europe's magnet problem

Interview to Dr. Alberto Bollero, coordinator of European project NANOPYME,

http://horizon-magazine.eu/article/positive-solutions-europe-s-magnet-problem_en.html



13.08.2015

IMDEA Nanociencia en los informativos de Telemadrid

IMDEA Nanociencia en el programa de divulgación científica ConCiencia, de Telemadrid

<http://www.nanociencia.imdea.org/noticias/2015/imdea-nanociencia-los-informativos-telemadrid>
<https://vimeo.com/138902994>

10.11.2015

El País (newspaper)

La ciencia es un universo paralelo de nuestra vida cotidiana ("Science is a parallel universe of our daily life")

J.R. Arias-Gonzalez

http://elpais.com/elpais/2015/11/04/ciencia/1446660019_265123.html

01.12.2015

Cadena Ser

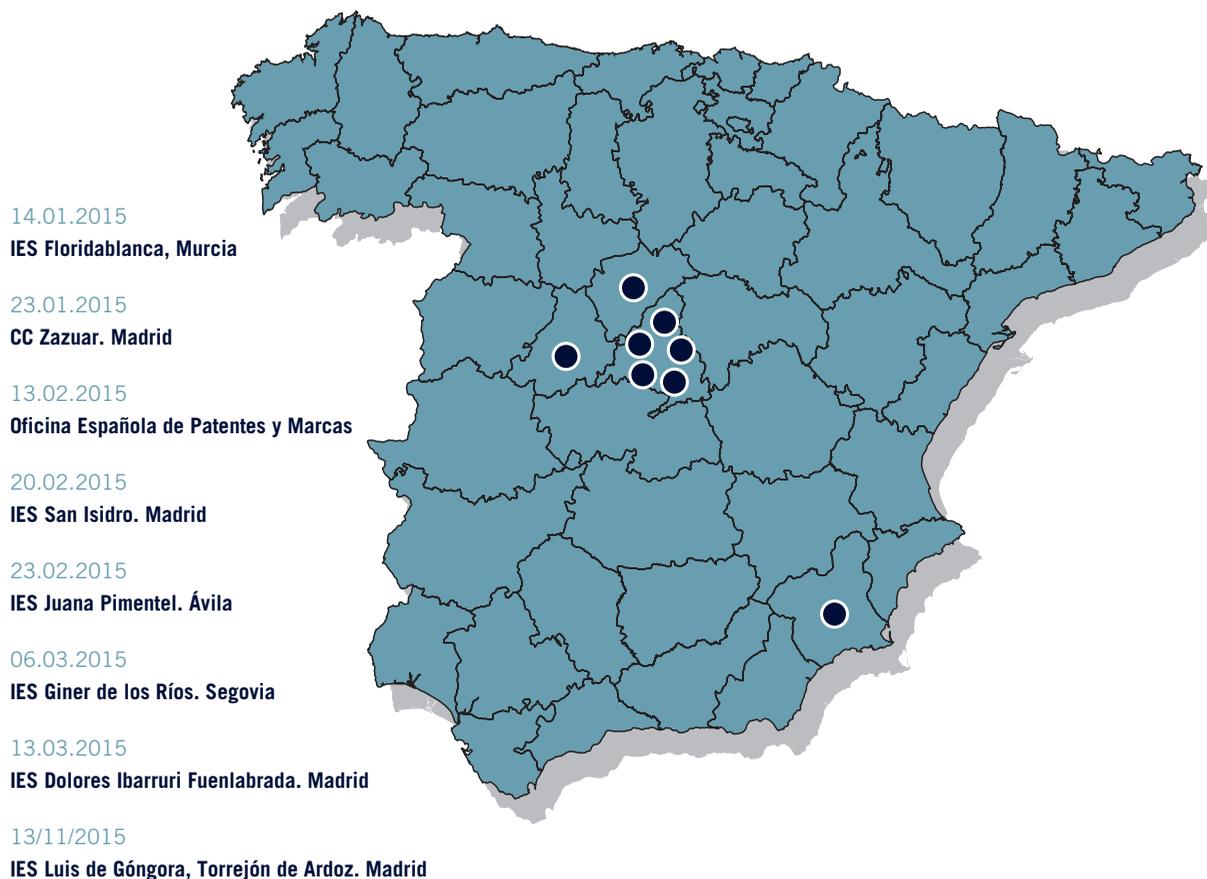
Semana de la Ciencia

A. Somoza

<http://play.cadenaser.com/audio/000WB0024720141105152027/>
 contamos-actividades-de-semana-de-ciencia-hoy-por-hoy-madrid/

Nanociencia para todos

Nanociencia para Todos is an outreach program arisen in response to the demand on popular science activities from the citizens of Madrid, a demand that we noticed trough the overwhelming attention of our proposals in the Semana de la Ciencia de Madrid. We believe that one of our duties is contributing to the creation of links between Science and Society in our region. *Nanociencia para Todos* is a monthly “Open Days” activity in which we receive mainly students from the last years of high school. In 2015 we received over **250** students, teachers and citizens.



Some of our activities:

[Learn about IMDEA Nanociencia's microscopes](#)

Do you know what SNOM, AFM, SEM or STM stands for? Did you know that they refer to different microscopes with which to explore the matter with atomic resolution?

During the visit you will get to know what they are used for and how each of them works in very different conditions: from terrestrial environmental conditions to the ones similar to the conditions of interstellar space (ultra high vacuum and low temperature). IMDEA Nanociencia researchers will tell you how they manufacture themselves parts of some of the microscopes.

Nanostructure is key

Nanostructure is key to the development of future organic photovoltaic cells, organic conjugated lenses for flexible or bright large screens integrated for indoors or outdoors but also for the biological activity of molecular motors and individual biomolecules, surface wetting and superhydrophobicity, among others.

During the visit you will learn about how scale determines the properties of matter and how organic and inorganic matter behave similarly at the nanoscale.

Nanoparticles

Gold nanoparticles, nanoclusters of gold and magnetic nanoparticles. Which are their properties? What about the applications? IMDEA Nanociencia researchers are working in the synthesis of magnetic nanoparticles and functionalization to use them in the diagnosis and treatment of different types of cancer.

During the visit you will discover the properties of different types of nanoparticles, we will show you the magnetic properties of nanoparticles and how the heat generated is measured, what is the origin of the heating process and the interest of using nanoparticles to treat cancer.

New Permanent Magnets

energy. It has become obvious over the years that an increased use of low carbon technologies is necessary to ensure a high living standard of citizens. Permanent magnets (PMs), used in multitude of technological applications, play a very important role in these efforts.

The New Permanent Magnets Lab at IMDEA Nanociencia aims at developing RE-free PMs as alternative to controversial Nd-Dy-Fe-B magnets. During the visit the Division of Permanent Magnets and Applications will show you how they are trying to achieve these goals and will tell you about the fundamental scientific issues they address as well as the social, economical and political implications of the PMs development.

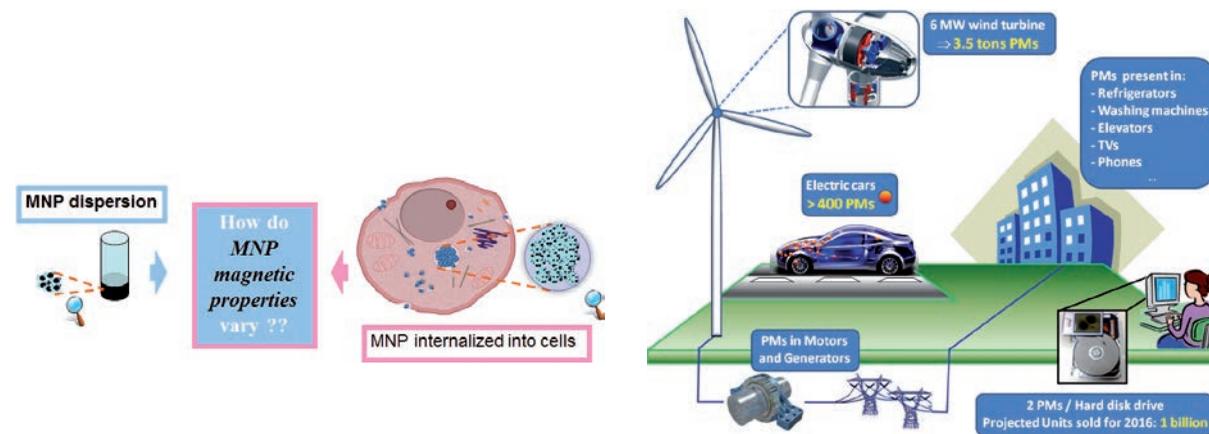
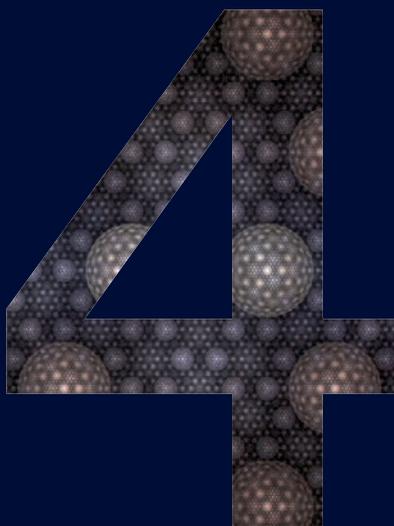


Figure 1. Role of nanoscale technological applications: from energy generation, going through energy transformation and to devices (Image: IMDEA Nanociencia)



r e s e a r c h
f o c u s



4.1. Ultrathin semiconductors:
towards flexible optoelectronics [174]

annual report
2015

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Ultrathin semiconductors: towards flexible optoelectronics

Fundación BBVA: Ayudas a Investigadores, Innovadores y Creadores Culturales

Dr. Andrés Castellanos Gómez
40.000€ 1 year 2015-2016

The search for sustainable and cheap energy sources is amongst the most pressing social challenges. The growing demand for energy in our society requires finding alternative methods to ensure equal access to energy sources. A very appealing approach to address this challenge is trying to harvest all the solar energy, otherwise wasted. This strategy should be based on the concept of 'ubiquitous energy harvesting', incorporating solar cells on any free surface.

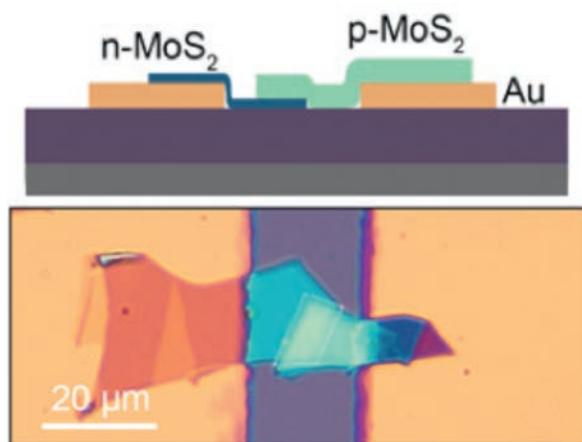
Two-dimensional materials have been recently isolated and promise to revolutionize the field of flexible optoelectronics. The aim of this project is to combine two of the most attractive properties of two-dimensional semiconductors (their extraordinary flexibility and remarkable optoelectronic properties) in order to realize proof-of-concept flexible optoelectronic devices. To this end optoelectronic devices will be manufactured by transferring these atomically thin semiconductors onto flexible substrates. Special attention to the case of flexible solar cells will be given because of its potential social impact in the energetic societal problem and to photodetectors because of its industrial interest in imaging systems (especially night vision systems). We plan to employ molybdenum disulfide, a highly abundant two-dimensional layered semiconductor, to fabricate the optoelectronic devices. By mechanical exfoliation of bulk crystals, one can achieve high quality two-dimensional layers of molybdenum disulfide large enough to fabricate proof-of-concept devices. The performance of these new optoelectronic devices will be characterized for different levels of deformation, to evaluate its potential in flexible electronics applications.

towards flexible
optoelectronics

iconductors:

BBVA

The project proposed here addresses important key scientific issues, both from the fundamental and applied point of view. The proposed project is at the forefront of materials science of two-dimensional materials since the manufacture of flexible devices with features such as solar cells or photodetectors is beyond the state of the art. Indeed, the results of this project will constitute a first step towards designing new transparent and flexible optoelectronic devices. These new kind of electronic components have the potential to be integrated on almost any surface without having a strong impact on its aesthetics enabling for their integration in building façades or with wearable electronics to power low-consumption devices. Although the project plans to use mechanically exfoliated material for the fabrication of the proposed devices, the success of this project will certainly trigger future works on the use of large area synthesis methods to replicate the results at large scale.



Optical image of an ultrathin solar cell fabricated by deterministic placement of 2D semiconductors: one n-type and another p-type to form a PN junction.

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imdea nanoscience institute

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