nanoscience and nanotechnology:
small is different

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annual report 2016

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foreword

foreword

Rodolfo Miranda
Director, IMDEA Nanociencia Institute
june 2016

annual report
2016

The consolidation of IMDEA Nano as an international reference in the field of nanotechnology has had significant advances in 2016.

We have installed several new facilities: a liquefier plant to produce liquid Helium from the recovered gas, a new STEM microscope, a roll to roll nanoimprint pilot plant for the production of nanostructured functional surfaces and a new Joule-Thompson STM which can go down to a temperature of 800 mK with 3 Teslas applied magnetic field.

The scientific production of the Institute has reached 200 papers/ year with an accumulated number of citations of the order of 18000 and a healthy parabolic increase with time. The institutional h index at the end of 2016 was 61.

In terms of financial support we have reached the point of getting 2/3 of our budget from external, competitive sources, with only 1/3 coming directly from the administration. This figure, unprecedented for Spanish institutions, demonstrate that we are very competitive, but at the same time, places us in a somewhat fragile situation, since we are too dependent on continuing this extraordinary success rate in external projects. That is why we should prepare ourselves to try and secure stable funding in the next future through programs such as the Severo Ochoa call for Centers of Excellence.

We have also reorganized our governance structure by appointing three Deputy Directors for Scientific Strategy (Dr. Julio Camarero), Outreach (Dr. Emilio Pérez) and Infrastructure (Dr. Daniel Granados). Together with the Executive Manager, Vicedirector and Director they form the Executive Commission.

In summary, I am confident that we are on the right track to establish IMDEA Nano as a well-recognized Center of Excellence, thanks to the talent and commitment of all people involved in its activities. It is a privilege for me to be part of this adventure.

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overview

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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 Cientificas), industries, members of the Scientific Advisory Council, and experts in societal implications of nanoscience and technology transfer.

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

1.2. Strategic Goals

In the Madrid region there is 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 for the future international competitiveness of R+D in Nanoscience and Nanotechnology. A suitable organizational and working environment needs to be created with the aim to promote the continuous interdisciplinary interaction between specialists in physics, chemistry, molecular biology, computer sciences, etc., that the very nature of this new discipline demands.

Most importantly, it is essential to be able to recruit and retain new talent and to repatriate young scientists working abroad, to train a new generation of technicians and scientists in a genuine interdisciplinary field, and to create and maintain new experimental equipment 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 centre, whilst maintaining a clear support from the existing scientific community in Madrid.

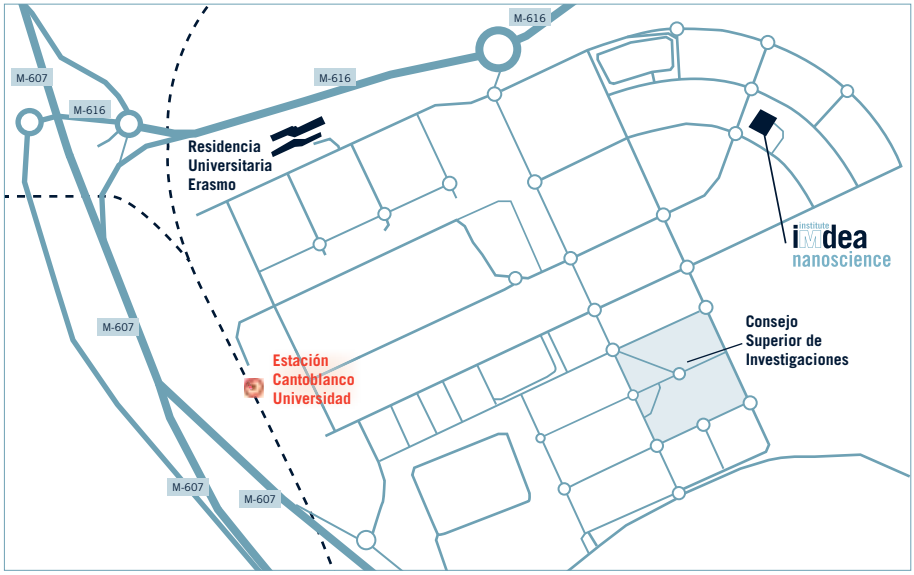
1.3. Location

Initially, the Foundation started up its activities in spaces loaned by other academic research institutions such as the UAM School of Sciences and the UCM School of Chemistry. The new building of IMDEA is located on the Cantoblanco Campus of UAM, near Madrid. The foundation stone was laid in a public ceremony on 13th January 2010. The building was completed by December 2011 and has been fully operational since June 2012. Its 10,000 m^2 host 44 specific laboratories, as well as the Centre for NanoFabrication with state of the art facilities and world-class equipment.

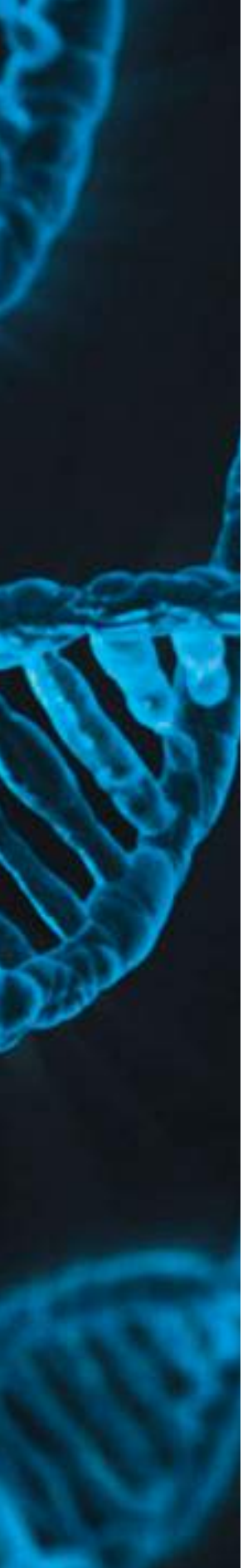
Given the interdisciplinary nature of research in Nanoscience, the location of the Institute in a campus characterized by its excellence in related research areas provides the perfect environment.

1.4. Recruitment Procedure

The scientific research staff is selected worldwide strictly on the basis of research merit. The recruitment is carried out by means of International Open Calls, with pre-screening by the Scientific Advisory Committee (SAC) to provide a short list of potential candidates. The candidates then go through a process of interviews and discussion on the specific conditions for joining the Institute. After the interview process, the selected candidates are presented to the Board of Trustees and the corresponding offers are presented. The scientists are provided with laboratory space and start-up funds to facilitate their incor-



IMDEA Nanociencia. Universidad Autónoma de Madrid. Cantoblanco Campus.



poration to the Institute and in the case of junior researchers, help them to boost their careers. Researchers from universities and other Spanish research institutions may also apply to the same selection procedure, to be incorporated to the Institute as associated members for periods of five years to develop specific research projects.

At IMDEA Nanociencia, regardless of the scientific category (senior researcher, researcher or associated scientist), the activity of all the scientific staff is periodically scrutinized. During SAC evaluation meetings, 25% of the staff scientists are asked to give an oral report of their activities. This evaluation determines whether the scientist is renewed, promoted or has their contract cancelled. This periodic evaluation is based on criteria known in advance, which are based on scientific outputs, leadership, collaborations, etc. Figures from 2016 are shown below:

- Research Staff: IMDEA Nanociencia has hosted a total of 29 researchers, 7 of which have come from 4 different foreign countries. The excellence of the centre has been demonstrated by the 9 researchers obtaining contracts through the highly competitive Ramon y Cajal Calls.

- Postdoctoral: 9 of the total of 32 postdoctoral researchers recruited have been through different international competitive calls (Marie Skłodowska-Curie, Rubicon, Juan de la Cierva actions). 47% of our postdocs (15 of 32) come from 11 different foreign countries.

- Predoctoral: Of the total of 44 predoctoral researchers, 5 were recruited through Marie Curie actions (ITN), and 3 through competitive national calls. There are also an additional 18 predoctoral students financed directly for other institutions. Of note is the collaboration with the Chinese Scholarship Council that has allowed IMDEA Nanociencia to host 9 Chinese PhD students.

- Technical Staff: The Institute is supported by 18 technicians, both specialized and support staff. Of these, 6 have been hired through national competitive calls.

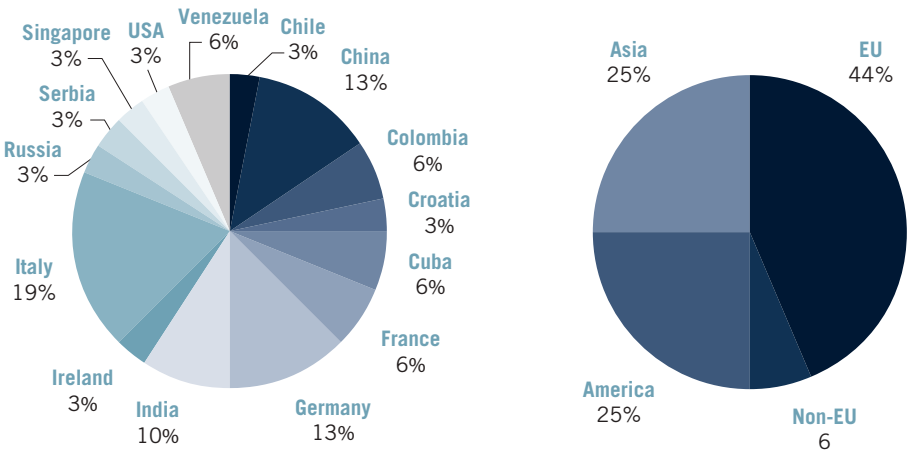
- Associated Scientists: 20 researchers from various institutions have associated scientist status with IMDEA Nanociencia in 2016.

1.5. Gender Balance

IMDEA Nanociencia has a strong commitment towards gender equality, and since its inception has implemented measures that have been successfully adopted regarding flexibility in the working hours schedules and teleworking.

The number of female researchers at IMDEA Nanociencia is 35%, (43 of 123) which is higher than the percentage of female researchers in the EU-28.[1] Although there is still work to do to reach gender equality, IMDEA Nanociencia has a strong commitment to comply with gender equality in the workplace. IMDEA is actively promoting the appointment of outstanding female researchers with a strong emphasis on research excellence.

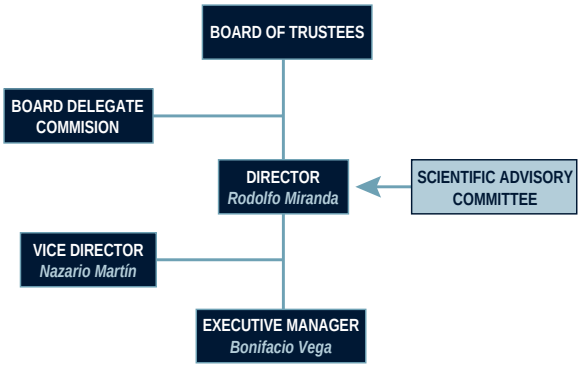
Foreign researchers at IMDEA Nanociencia 2016



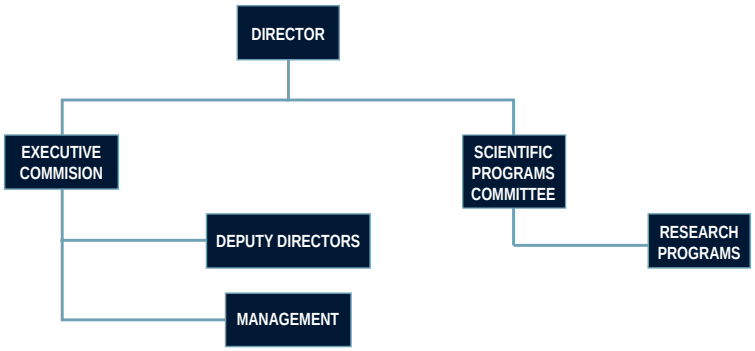
[1] SHE Figures 2015, EU Commission.

1.6. Management Structure

Legally Binding Governing Structure



Internal Governing Structure



Research Programs Committee

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Prof. J. Gierschner

Prof. I. Rodríguez

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Prof. N. Martín

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Prof. C. Flors

Prof. E. Pérez

Rodolfo Miranda
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Emilio Pérez
DEPUTY DIRECTOR
SCIENTIFIC OUTREACH

Nazario Martín
VICEDIRECTOR

EXECUTIVE COMMISSION

Daniel Granados
DEPUTY DIRECTOR
SCIENTIFIC INFRAESTRUCTURE

Julio Camarero
DEPUTY DIRECTOR
SCIENTIFIC STRATEGY

Bonifacio Vega
EXECUTIVE MANAGER

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

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Counselor for Education Madrid Regional Government. Spain

Prof. José Manuel Torralba
General Director of Universities and Research Madrid Regional Government, Spain

Mr. Rafael García Muñoz
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Mr. José de la Sota
Managing Director Fundación madri+d para el Conocimiento, Madrid. Spain

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Cornell University. USA

Prof. Cayetano López
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Prof. Miquel Salmerón
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Mr. Valentín Ruíz Santa Quiteria

1.8. Scientific Advisory Committee

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

Prof. Héctor Abruña
Cornell University, USA.

Prof. Johannes Barth
University Munich, Germany

Prof. Harald Brune
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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
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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. Universita 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

Programe Manager: Prof. Nazario Martín

Nanocarbons and Organic Photovoltaics
Prof. Nazario Martín

Chemistry of Low-Dimensional Materials
Prof. Emilio M. Pérez

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
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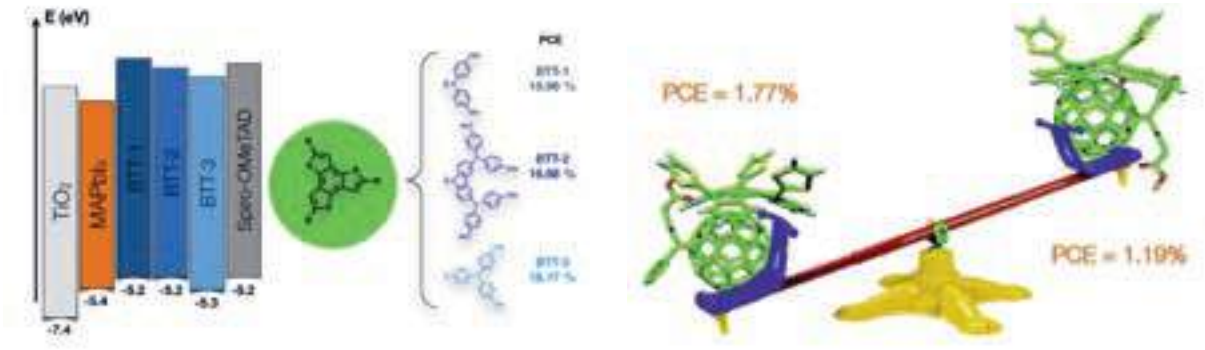
Nazario Martín is full professor of Organic Chemistry at the University Complutense of Madrid and vice-director of IMDEA-Nanoscience. He has served as a member of the Editorial Board of *Chemical Communications*. He has been a member of the International Editorial Advisory Board of *The Journal of Materials 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 Edictor-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.

Dr. Agustín Molina
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University of Texas at El Paso, USA

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Postdoc
Durham University, UK

Inés García
Ph.D. student

Valentina Sacchetti
Ph.D. student (Universita degli Studi dell'Aquila, Italy)

Rafael Sandoval
Ph.D. student

Dr. Saeid Khodabakhshi
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Chemistry of Low-Dimensional Materials

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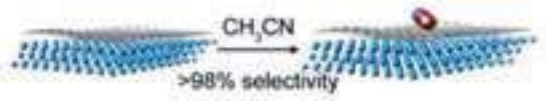
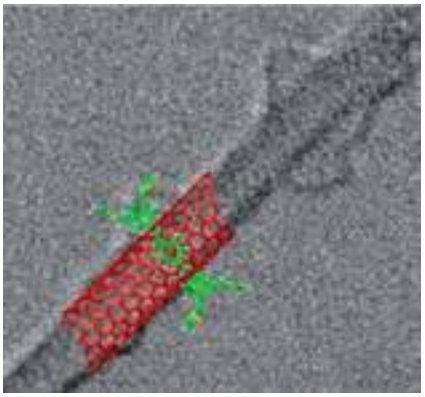
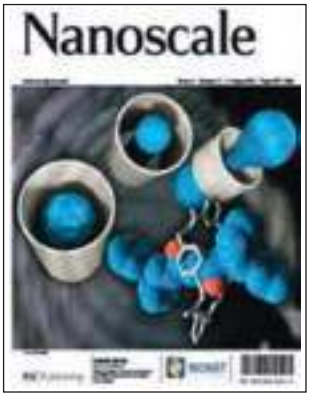
Group webpage: Chemistry of Low-Dimensional Materials

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 (*Angew. Chem. Int. Ed.,* 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 constants towards SWNTs (*Chem. Sci.* 2015). We are also interested in the self-assembly of functional materials (*Angew. Chem. Int. Ed.,* 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 (*Nano Lett.* 2016, *Int. J. Mol. Sci.* 2015).







Chemistry of Low-Dimensional Materials

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Julia Villalva
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Switchable Nanomaterials

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Researcher ID: http://www.researcherid.com/rid/B-4329-2008

During his PhD in Physical-Chemistry from the ICMCB-CNRS (Bordeaux) and later throughout three European post-doctorates states at the University of Mainz, Leiden Institute of Chemistry and the University of Barcelona, where he initially held a Juan de la Cierva fellowship, he became an expert in the design, synthesis and characterization of novel molecular-based functional materials. In 2012 he was awarded with an IEF Senior Marie Curie Fellowship at the LCC-CNRS in Toulouse to work on size-reduction effect on switchable coordination chemistry materials called Spin Crossover. Later, he obtained a "Ramon y Cajal" fellowship and joined in 2016 IMDEA Nanoscience as Researcher. He is co-author of more than 62 papers with an h-index=24.

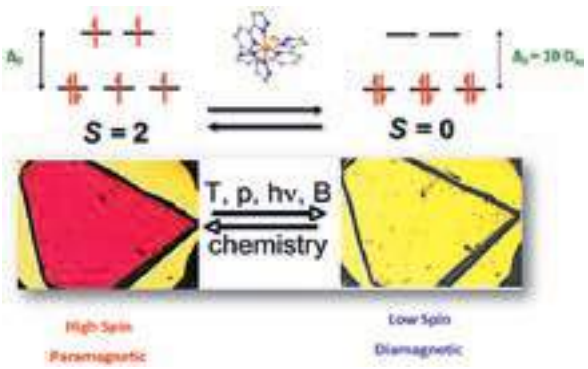
Estefanía Fernández
Ph.D. student

Research Lines

My research line is centred on the frontier areas of Coordination Chemistry, Inorganic Chemistry and Material Science on the development of new metal-based coordination complexes at the macro- and nanoscopic scale for their technological application in the fields of magnetism, energy storage, catalysis, memory and sensing devices.

Relevant Publications

- Snapshots of a solid-state transformation: coexistence of three phases trapped in one crystal. *Chem. Sci.,* 2016, **7**, 2907-2915.
- Three-Way Crystal-to-Crystal Reversible Transformation and Controlled Spin Switching by a Nonporous Molecular Material. *J. Am. Chem. Soc.* **2014**, 136, 3869.
- The photo-thermal plasmonic effect in spin crossover@silica–gold nanocomposites.
- Crystallographic Evidence for Reversible Symmetry Breaking in a Spin-Crossover d^7Cobalt(II) Coordination Polymer. *Angew. Chem. Int. Ed.,* **2012**, 51, 2142.



Functional Organic Materials

Prof. Tomás Torres
Associate Research Professor
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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.

Dr. Maxence Urbani

Dr. Miguel Garcia Iglesias

Olga Trukhina
Ph.D. student

Luis M. Mateo
Ph.D. student

David B Guzmán
Ph.D. student

Nicolas Muñoz
Ph.D. studen

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,* 5560.

Electrochemical Biosensors

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Researcher ID: http://www.researcherid.com/rid/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.

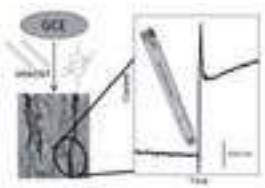
Dr. Félix Pariente
Dr. Mónica Revenga
Dr. Tania García Mendiola
Dr. Emiliano Martinez-Periñán
María Briones Llaguno
Ph.D. student

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.

Recent Publications

- Insulin sensor based on nanoparticle-decorated multiwalled carbon nanotubes modified electrodes. *Sens. Actuator B-Chem.,* **222** (2016) 331.
- Dyes as bifunctional markers of DNA hybridization on surfaces and mutation detection. *Bioelectrochemistry* **111** (2016) 115.
- Nanostructured electrochemical detector for the quantification of amino acids related to metabolic diseases. *Sens. Actuator B-Chem.,* **236** (2016) 773.
- Gallium plasmonic nanoparticles for label-free DNA and single nucleotide polymorphism sensing. *Nanoscale* (2016), **8**, 9842.
- The mechanical bond on carbon nanotubes: diameter-selective functionalization and effects on physical properties. *Nanoscale* (2016), **8**, 9254.
- Electrocatalytic processes promoted by diamond nanoparticles in enzymatic biosensing devices. *Bioelectrochemistry* **111** (2016), 93.
- Diamond nanoparticles as a way to improve electron transfer in sol- gel L-lactate biosensing platforms. *Anal. Chim. Acta* **908** (2016) 141.
- Metallacarboranes as tunable redox potential electrochemical indicators for screening of gene mutation. *Chem. Sci.,* (2016), **7**, 5786.
- Multi-tasking Schiff base ligand: A new concept of AuNPs synthesis *Anal. Bioanal. Chem.* **408** (2016), 2329.



Biosensors

Prof. José Manuel Pingarrón
Associate Research Professor
Ph.D.: Universidad Complutense de Madrid, Spain
Double Affiliation: Universidad Complutense de Madrid, Spain
ORCID: http://orcid.org/0000-0003-2271-1383
Researcher ID: M-9402-2014
Scopus Author ID: 7005489861
Group webpage: http://geberesearch.wixsite.com/-ucm

Jose M. Pingarrón obtained his Ph.D. (1981) from Complutense University of Madrid. Between 1982 and 1983, he did postdoctoral training at the Ecole Nationale Superieure de Chimie de Paris. Since 1994, he is a full Professor of Analytical Chemistry at the Complutense University of Madrid. He 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. He has been 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/coauthor of 358 peer-reviewed papers, 28 book chapters, 2 text books and 7 invention patents. He is currently Vice-Chancellor for the Transfer of Knowledge and Entrepreneurship at the Universidad Complutense de Madrid, International Society of Electrochemistry (ISE) Fellow, Vice-President of the Spanish Royal Society of Chemistry and his representative in the Division of Analytical Chemistry of the European Association for Chemical and Molecular Sciences. He 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, he is co-founder of the "spin-off" company Inbea Biosensores S.L.

Research Lines

- Fundamental Research:

  Synthesis, characterization and application of latest generation nanomaterials, redox polymers/electronic conductors and modern electroanalytical techniques in electrochemical (bio)sensing.

- Applied Research:

  Development and application of advanced electrochemical (bio)sensors for the determination of relevant (bio)markers in the environmental, clinical and food fields in response to current demands of society.

Recent Publications

- Reduced graphene oxide-carboxymethylcellulose layered with platinum nanoparticles/PAMAM dendrimer/magnetic nanoparticles hybrids. Application to the preparation of enzyme electrochemical biosensors *Sens. Actuator B-Chem.,* **232** (2016) 84-90.
- Novel reduced graphene oxide-glycol chitosan nanohybrid for the assembly of amperometric enzyme biosensor for phenols *Analyst* **141** (2016) 4162-4169.
- Amperometric xanthine biosensors using glassy carbon electrodes modified with electrografted porous silica nanomaterials loaded with xanthine oxidase *Microchim Acta* **183** (2016) 2023-2030.
- Neoglycoenzyme-gated mesoporous silica nanoparticles: toward the design of nanodevices for pulsatile programmed sequential delivery. *ACS Appl. Mater. Interfaces* **8** (2016) 7657-7665.

Covalent Organic Frameworks

Prof. Félix Zamora
Associate Research Professor
Ph.D.: Universidad Autónoma de Madrid, Spain
Double Affiliation: Universidad Autónoma de Madrid, Spain
ORCID: http://orcid.org/0000-0001-7529-5120
Researcher ID: http://www.researcherid.com/rid/E-6265-2014
Group webpage: Covalent Organic Frameworks

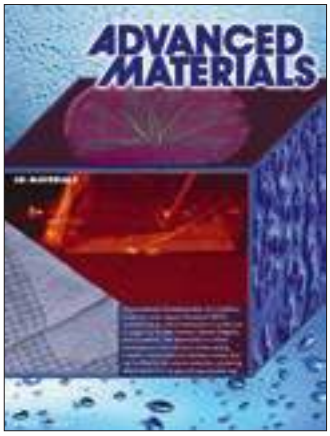
Félix Zamora is Professor at the Department of Inorganic Chemistry of the UAM and research associate of IMDEA Nanoscience. He obtained his BSc, MSc and PhD in Universidad Autónoma de Madrid (UAM). Then he got a Postdoctoral HTMR fellowship at the University of Dortmund (Germany) with Prof. B. Lippert. 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).

Carlos Gibaja
Ph.D. student

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 [C*hem. Eur. J.* **21**, 10666-10670, 2015].



Hybrid Nanomaterials

Dr. Beatriz H. Juárez
Associate Researcher
Ph.D.: Universidad Autónoma de Madrid, Spain
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Researcher ID: http://www.researcherid.com/rid/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://luxrerum.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.

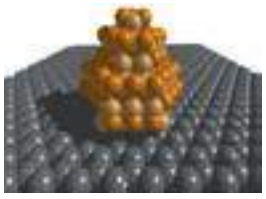
Maria Acebrón
Ph.D. student

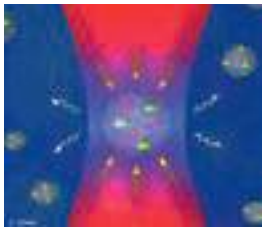
Héctor Rodríguez
Ph.D. student

Diego Ruiz
Technician

Research Lines

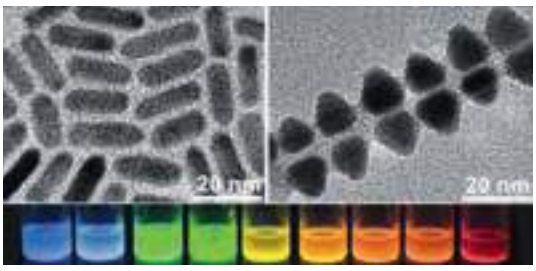
The nanoparticles laboratory (http://www.nanoscience.imdea.org/nanoparticles-lab) is mainly dedicated to the synthesis of colloidal semiconductor nanoparticles (quantum dots). The research lines include the synthesis of colloidal nanocrystal and hybrid systems, further processing, surface chemistry studies 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. *ACS Appl. Mater. Interfaces*, 2015, **7**, 6935-6945.
- Interfacing quantum dots and graphitic surfaces with Cl-based atomic ligands. *ACS Nano*. **7**, 3, 2559 (2013).
- Plasmon-exciton interactions on single photoresponsive platforms demonstrated by optical tweezers. *Nano Letters*, **11**, 4742–4747 (2011).
- Ultrathin PbS Sheets by two dimensional oriented attachment. *Science* **329**, 550 (2010).



Synthesis and Study of Porphyrinoid-based Covalentand Supramolecular Ensembles

Dr. Giovanni Bottari
Associate Researcher
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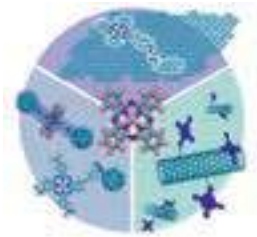
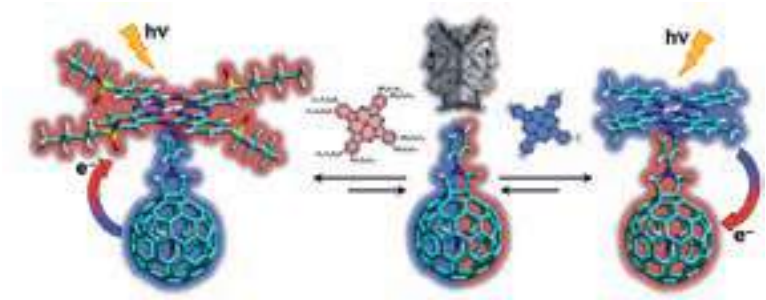
Double Affiliation: Universidad Autónoma de Madrid, Spain
ORCID: http://orcid.org/0000-0001-6141-7027
Researcher ID: http://www.researcherid.com/rid/A-8957-2013
Group webpage: http://www.phthalocyanines.es/

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 both at IMDEA Nanociencia (2014) and at the Institute for Advanced Research in Chemical Sciences (IAdChem) (2016). In 2016, he has received the "John Shelnutt Young Investigator Award" from the "Society of Porphyrins and Phthalocyanines (SPP)", an award which recognize the outstanding contribution of young researchers in the field of porphyrins and phthalocyanines.

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, pi-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 sensors for both polarity and viscosity in organic media as well as in living cells.





Synthesis and Study of Porphyrinoid-based Covalentand Supramolecular Ensembles

Relevant Publications

- Phthalocyanine-nanocarbon ensembles: From discrete molecular and supramolecular systems to hybrid nanomaterials, *Acc. Chem. Res.,* **48**, 900-910 (2015).
- Bidirectional electron transfer capability in phthalocyanine–$Sc_3N@I_h$-C_{80} complexes, *J. Am. Chem. Soc.,* **137**, 12914-12922 (2015).
- A fluorescent molecular rotor showing vapochromism, aggregation-induced emission, and environmental sensing in living cells, *J. Mat. Chem. C* **4**, 3018-3027 (2016).
- Intense ground-state charge-transfer interactions in low-bandgap, panchromatic phthalocyanine-tetracyanobuta-1,3-diene conjugates, *Angew. Chem. Int. Ed.,* **55**, 5560-5564 (2016).
- Regio-, stereo- and atropselective synthesis of C60 fullerene bisadducts by supramolecular-directed functionalization, *Angew. Chem. Int. Ed.,* **55**, 11020-11025 (2016).

program
time-resolved optical spectroscopy

Programe Manager: Prof. Johannes Gierschner

Photophysics of Organic and Hybrid Supramolecular Nanosystems
Prof. Johannes Gierschner

Pump-probe Photoinduced Absorption Spectroscopy
Dr. Juan Cabanillas-González

Femtosecond Spectroscopy on Molecular Systems
Prof. Larry Luer

Nanooptics and Nanoacoustics
Prof. Reinhold Wannemacher

Photophysics of Organic and Hybrid Supramolecular Nanosystems

Prof. Johannes Gierschner
Senior Research Professor
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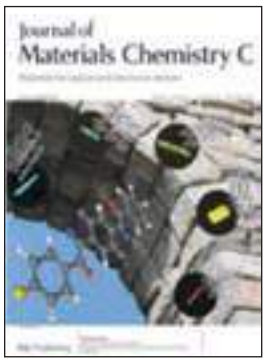
Researcher ID: http://www.researcherid.com/rid/K-7938-2014
LOOP profile: 85616
Scopus Author ID: 6603576997
Group webpage: Time-resolved Optical Spectroscopy

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.* 2016, **116**, 4937-4982.

Photophysics of Organic and Hybrid Supramolecular Nanosystems

- 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. Paramjyothi C. Nandajan
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National Institute for Interdisciplinary Science and Technology (CSIR-NIIST)

Shi Junquing
PhD. student
Beijing Normal University, China

Eliezer F. Oliveira
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Univ. Estadual Paulista, Bauru, Brazil

Dr. Begoña Milian
Visiting Researcher
Universidad de Valencia, Spain

Femtosecond Spectroscopy on Molecular Systems

Prof. Larry Luer
Senior Research Professor
Ph.D.: University of Tubingen, Germany
Previous Position: Politecnico di Milano, Italy
Researcher ID: http://www.researcherid.com/rid/L-9375-2014

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

Dr. Anna Isakoba
Postdoc
Aston University, UK

Abasi Abudulimu
Ph.D. student
Umea University, Sweden

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 (OCS).** 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).

Nanooptics and Nanoacoustics

Prof. Reinhold Wannemacher
Senior Research Professor
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 has been partly performed at The University of Georgia, IBM Almaden Research Laboratory, Rijksuniversiteit Leiden, Technische Universität Chemitz, and Universität Leipzig. He has been a Guest Professor for Nano-Optics at Technische Universitat Chemnitz, as well as a member of the Faculty of Physics and Geosciences of the University of Leipzig. He is the author of about 80 scientific articles.

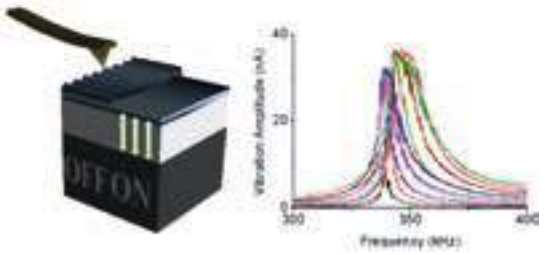
Research Lines

- Nano-optics and plasmonics.
- 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.
- Optical microscopy in the near and far field.
- Lasing of conjugate organic materials.

Phase-sensitive acoustic microscopy, imaging, and non-destructive testing. ultrasonic AFM (atomic force acoustic microscopy, AFAM, ultrasonic force microscopy, UFM).

Dr. Daniel Cano
Postdoc
Eberhard-Karls-Universit at Tuubingen,Germany

Álvaro Larriba (URJ)
Internship



Pump-probe Photoinduced Absorption Spectroscopy

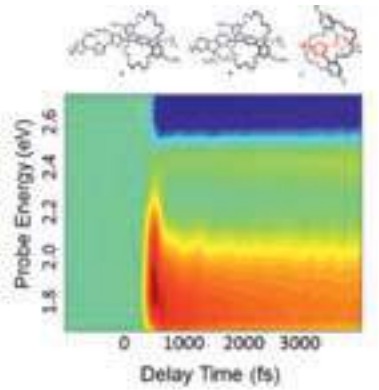
Dr. Juan Cabanillas-González
Research Professor
Ph.D.: Imperial College London, UK
Previous Position: Politecnico di Milano, Italy
Researcher ID: M-1026-2014

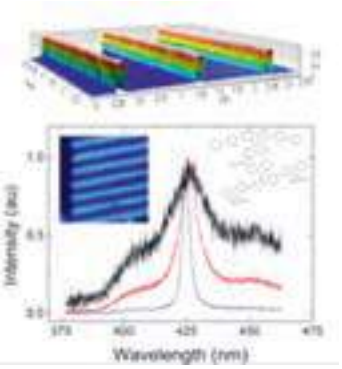
Juan Cabanillas-Gonzalez graduated in Physics at Universidade de Santiago de Compostela in 1999. He got a PhD in Physics from Imperial College London working with photophysics of conjugated polymers with Prof. Donal Bradley. In 2003 he started a post-doctoral stage at Politecnico di Milano with Prof. 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

1. **Conjugated polymers for photonics: relation between structure and light amplification properties.** We study the optical gain and stimulated emission properties of conjugated polymers with femtosecond transient absorption spectroscopy. We focus on chemical structures designed to promote optical gain upon reducing inter-chain interactions. Examples are conjugated polyrotaxanes with cyclodextrin rings surrounding the backbone, conjugated molecules with bulky side-chain substituents or polymers with self-threading side-chains.

2. **Exciton dynamics in conjugated polymer blends.** Host: guest conjugated polymer mixtures coupled by Förster resonance energy transfer (FRET) are suitable candidates as optical gain medium in laser cavities. Achieving some degree of miscibility of host and guest polymers is crucial for outstanding light amplifying performance. We aim at optimizing the FRET and radiative decay rates upon morphology optimization through control of different parameters, (e.g. molecular weights, side-chain substitution, solvents for film processing).





Pump-probe Photoinduced Absorption Spectroscopy

3. **Fabrication and characterization of polymer waveguides and laser resonators by soft nanoimprint lithography.** We use soft nanoimprint to transfer periodic patterns onto semiconducting polymer films or on flexible substrates subsequently coated by conjugated polymer. Upon choosing the appropriate pitch for the periodic pattern we can achieve confinement of the emission in the conjugated polymer film and amplification of the optical cavity modes. This research lines is carried out in close collaboration with the group of Dr. Isabel Rodriguez at IMDEA Nanociencia.

4. **Fluorescent chemosensors.** We investigate the use of fluorescence, amplified spontaneous emission and laser action in cavity resonators as transduction signal for sensing analytes with high sensitivity in the gas or liquid phase. For this purpose we exploit the luminescent properties of electron-rich conjugated polymers and organic dyes and their tendency to undergo fluorescence quenching in the presence of analytes with large electron affinity.

Recent publications

- Quantifying the efficiency of förster-assisted optical gain in semiconducting polymer blends by excitation wavelength selective amplified spontaneous emission. *J. Poly. Sci. Pol. Phys.* **54**, 2311-2317 (2016).
- Novel Fluorene-Based Copolymers Containing Branched 2-Methyl-Butyl Substituted Fluorene-Co-Benzothiadiazole Units for Remarkable Optical Gain Enhancement in Green-Yellow Emission Range." *J. Phys. Chem. C,* 2016, **120** (21), pp 11350-11358.
- Flexible all-polymer waveguide for low threshold amplified spontaneous emission. *Sci. Rep.* **6**, 34565 (2016).
- A fluorescence gas sensor based on Förster Resonance Energy Transfer between polyfluorene and bromocresol green assembled in thin films. *Sens. Actuator B-Chem.* **236** (2016) 136-143.

Dr. José Raúl Castro
Postdoc
Universidad de Sevilla, Spain

Longfei Wu
Ph. D. student
Beijing Normal University, China

Chen Sun
Ph. D. student
Beijing Normal University, China

Giulin Liu
Visiting Ph.D. student
Jiangnan University, China

Qi Zhang
Visiting Ph.D. student
Nanjing University of Posts and Telecomunications, China

program

scanning probe microscopies and surfaces

Programe Manager: Prof. Rodolfo Miranda

Scanning Probe Microscopies and Surfaces
Prof. Rodolfo Miranda

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

Scanning Probe Microscopies and Surfaces

Prof. Rodolfo Miranda
Associate Research Professor
Ph.D.: Universidad Autónoma de Madrid, Spain
Double Affiliation: Universidad Autónoma de Madrid, Spain
ORCID: http://orcid.org/0000-0002-1064-6724
Researcher ID: 7102041777
http://nanoscience.imdea.org/rodolfomiranda/index.php/en/

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 fur 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.

Research Lines

- Atomic Scale Tunneling Microscopy And Spectroscopy.
- Dynamics at Surfaces.
- Fundamental Properties of Low Dimensional Systems and Quantum Materials.
- Magnetism of Nanostructures.
- Molecular Nanoscience At Surfaces.
- Nanomedicine.

Spin-Polarized low T STM

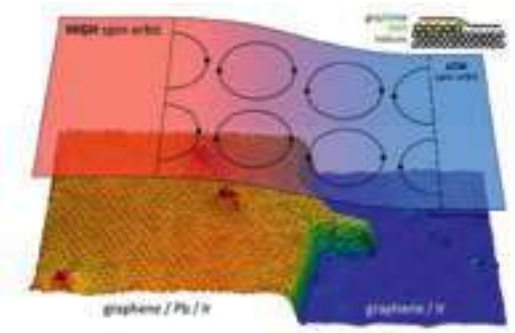
Dr. Fabián Calleja
Assistant Research Prof. (tenure track)
Ph.D.: Universidad Autónoma de Madrid, Spain
Previous Position: Ecole Polytechnique Federale de Lausanne (EPFL), Switzerland
Researcher ID: I-7964-2012

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 Politechnical 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 Jesús Navarro
Ph.D. student



Nanoarchitectures at Surfaces

Dr. David Écija
Assistant Research Prof. (tenure track)
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

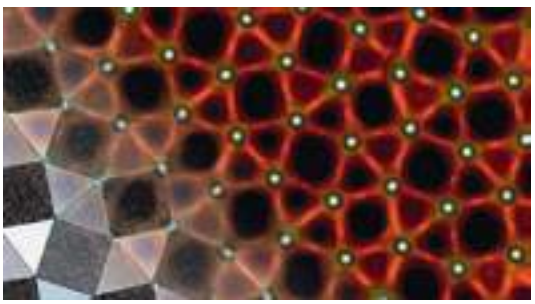
David Écija received a PhD degree in Physics from UAM, with a work on self-assembly of nanostructures on surfaces. He was awarded a Marie Curie Intra European Fellowship and moved to Prof. Barth´s group at the Technical University of Munich, where he carried out a four-year stay working on functional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

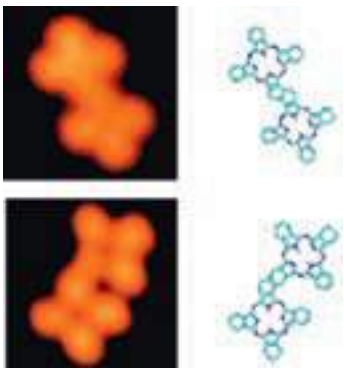
Research Lines

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





Nanotribology

Dr. Ruben Álvarez-Asencio
Researcher
Ph.D.: KTH, Sweden
Previous Position: KTH, Sweden

Research Lines

- At IMDEA Nanocienciat the nanotribology group is focused 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

miliKelvin STM

Prof. Amadeo L. Vázquez de Parga
Associate Research Professor
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 Physics1992 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

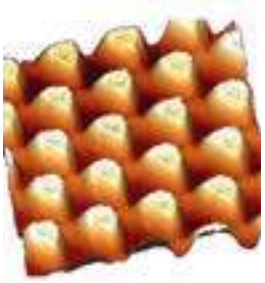
- The group is working on the characterization by means of low temperature scanning tunneling microscopy and spectroscopy (LT-STM/STS) the surface of epitaxial 2D materials and topological insulators. In particular we have been working on the growth of graphene on different transition metals and the 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).

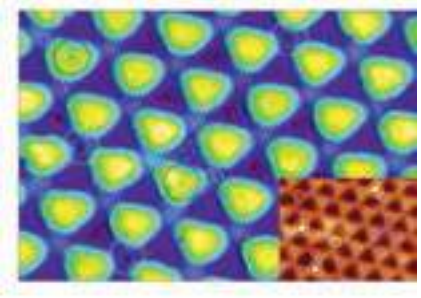
Dr. Andrew Norris
Assistant Research Prof. (tenure track)
Weizmann Institute, Israel.

Andrés Black
Ph.D. student

Pablo Casado
Ph.D. student

Cosme González
Ph.D. student





Modelling

Prof. Fernando Martín
Associate Research Professor
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.

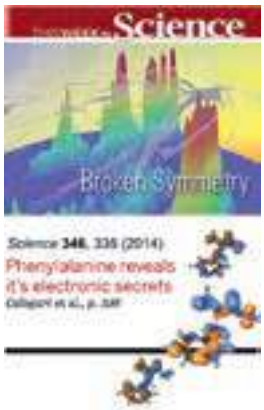
He has been PI of more than 20 grants. He has chaired several European networks, and has been the Spanish representative in the Atomic, Molecular and Optical Physics Division of the European Physical Society. He has supervised 16 doctoral and 14 master theses, and is currently Chair of the "Cátedra UAM-Fujitsu"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

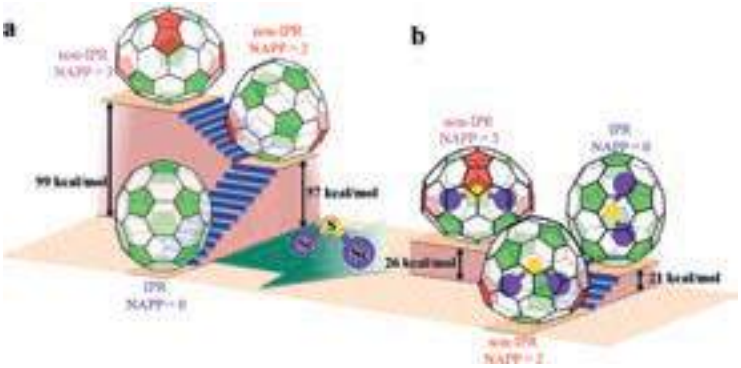
Prof. Manuel Alcamí
Associate Research Professor
PhD: Universidad Autónoma de Madrid, Spain
Double Affiliation: Universidad Autónoma de Madrid, Spain

Manuel Alcami 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.og) and the chair of the COST Action CM1204 XLIC: XUV/X-ray light and fast ions for ultrafast chemistry (www.xlic.eu). He has published more than 150 articles in international journals (h index 30), has been the IP of 6 research projects and supervised 6 PhD Thesis.

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. We have focussed our research in this topic in donor or acceptor organic molecules as TCNQ or TTF deposited on metal surfaces (*Nat. Chem.* **2**, 374, 2010) or Graphene (*Nat. Phys.* **9**, 368, 2013).
- Carbon nanostructures (fullerenes, nanotubes and graphene), in the last years we have developed simplify models to understand the stability of charged fullerenes (*Nat. Chem.* **7**. 927, 2015, *J. Am. Chem. Soc.* **138**, 1551, 2016), fullerene derivatives (*J. Am. Chem. Soc.* **139**, 1609, 2017) or He-decorated fullerenes (*Nat. Comm.* 13550, 2016).
- Fragmentation and stability of highly charged and highly excited molecules, in his field we have performed Molecular Dynamic simulations on excited states to describe the coupling between nuclear and electronic dynamics (*Angew. Chem. Int. Ed.* **52**, 3160, 2013), or to determine the energy deposit in ion collisions with biomolecules (*Phys. Rev. Lett.* **117**, 073201, 2016).



Photonic STM

Dr. Roberto Otero
Associate Researcher
Ph.D.: Universidad Autónoma de Madrid, Spain
Double Affiliation: Universidad Autónoma de Madrid, Spain
Researcher ID: E-4516-2011

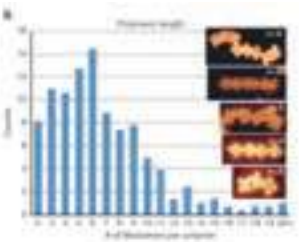
Roberto Otero obtained his PhD in 2002 from Universidad Autónoma de Madrid, where he investigated the relations between the morphology of nanostructures and their electronic structure. In 2002 he moved to the University of Aarhus in Denmark as a Research Assistant Professor funded through a Marie Curie 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 tenior position, which became permanent in 2011, and in 2008 he was recruited by IMDEA Nanoscience as Associated Researcher.

Alberto Martín
Ph.D. student

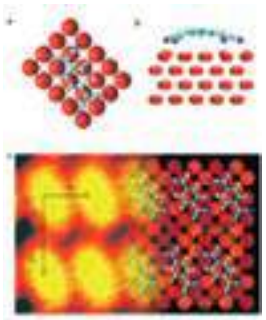
Research Lines

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)…].



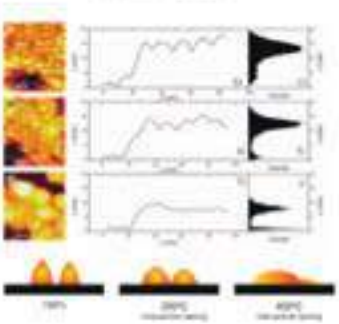
2. New covalent chemical reactions at solid surfaces, including the synthesis of graphene nanostructures [*Nature Communications* **7**, 11002 (2016)].



3. Growth and physical properties of 2D coordinations networks on solid surfaces [*Small* **11** 6358 (2015)].

4. Attachment and characterization of colloidal semiconducting quantum dots to solid surfaces [*ACS Nano* **7** 2559 (2013)].

5. Electrically induced light emission from individual organic molecules and nanostructures.



program
transport in 2D systems

Programe Manager: Prof. Jose Luis Vicent

Transport in 2D Systems
Prof. Jose Luis Vicent

Graphene
Prof. Francisco Guinea

2D Materials
Dr. Andrés Castellanos-Gómez

Electrical Conductivity of Single Molecules
Prof. Nicolás Agrait
Prof. Teresa González

Nanostructured superconductors
Dr. Elvira M. González

Transport in 2D Systems

Prof. Jose Luis Vicent
Double Affiliation: Universidad Complutense de Madrid, Spain
ORCID: http://orcid.org/0000-0001-9343-7671
Researcher ID: 7006735519

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.

Javier del Valle
PhD student

Fernando Galvez
PhD student

Victor Rollano
PhD student

Graphene

Prof. Francisco Guinea
Senior Research Prof.
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 Rüschlikon, 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 intheoretical 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. José Ángel Silva
Postdoc
ICMM-CSIC, Spain

Dr. Vincenzo Parente
Postdoc
Università degli Studi di Napoli "Federico II" Italy & ICMM-CSIC, Spain

Francesca Finocchiaro
Ph.D. student

Luis González Arraga
Ph.D. student

Ángel Gutiérrez
Ph.D. student

Ignacio Vicent
Ph.D. student

Maria del Rayo Chávez
Visiting Ph.D. student
Instituto de Fisica "Luis Rivera Terrazas", Universidad Autónoma de Puebla, Puebla, México

Electrical Conductivity of Single Molecules

Dr. Teresa González
Research Professor
Ph.D.: Universidad de Santiago de Compostela, Spain
Previous Position: University of Basel. Switzerland
ORCID ID: 0000-0001-0002-7253-797X
Researcher ID: http://www.researcherid.com/rid/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
Visitor
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… (*J. Am. Chem. Soc.* 2013, *J. Am. Chem. Soc.* 2014, *J. Am. Chem. Soc.* 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. Chem. Soc.* 2013, *Chem. Soc. Rev.* 2015…).
4. **Fullerene**-based molecular junctions (*Nano Lett.* 2011, *J. Org. Chem.* 2014).
5. **Graphene** as electrode for molecular electronics.
6. Molecular junctions under **electrochemical control**.

2D Materials

Dr. Andrés Castellanos-Gómez
Assistant Research Prof. (tenure track)
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

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.

Dr. David Pérez de Lara
Assistant Research Prof.
(tenure track)

Dr. Riccardo Frisenda
Posdoc
TU Delft, The Netherland

Patricia Gant
PhD student

Aday Molina-Mendoza
PhD student

Yue Niu
Visiting Ph.D. student
Harbin Institute of Technology, China

Foad Ghasemi
Visiting Ph.D. student
Teheran University, Iran

Luis Vaquero-Garzón (UAM)
Internship

Christoph Reuter
Visiting BSc - RISE DAAD program
Ulm University, Germany

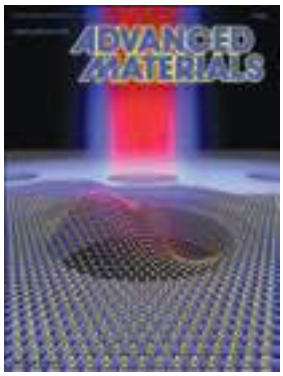
Sergio González-Abad (UAM)
Internship

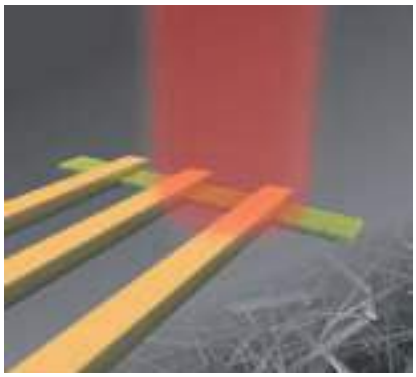
2D Materials

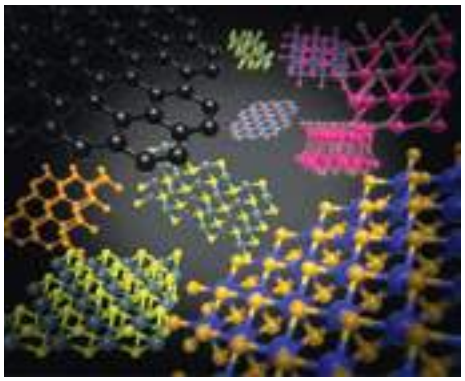
Research Lines

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,...).







Electrical Transport in Nanosystems

Prof. Nicolás Agraït
Associate Research Professor
Ph.D: UNED, Spain
Double Affiliation: Universidad Autónoma de Madrid. Spain
ORCID ID: 0000-0001-8177-7919
Researcher ID: http://www.researcherid.com/rid/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**.

Simon Svatec
Ph.D. student

1. **Electrical properties** of organic molecule families: oligo(phenyl ethynylene)s, oligoynes, phthalocyanines, porphyrins… (*J. Am. Chem. Soc.* 2013, *J. Am. Chem. Soc.* 2014, *J. Am. Chem. Soc.* 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. Chem. Soc.* 2013, *Chem. Soc. Rev.* 2015…).
4. **Fullerene**-based molecular junctions (*Nano Lett.* 2011, *J. Org. Chem.* 2014).
5. **Graphene** as electrode for molecular electronics.
6. Molecular junctions under **electrochemical control**.

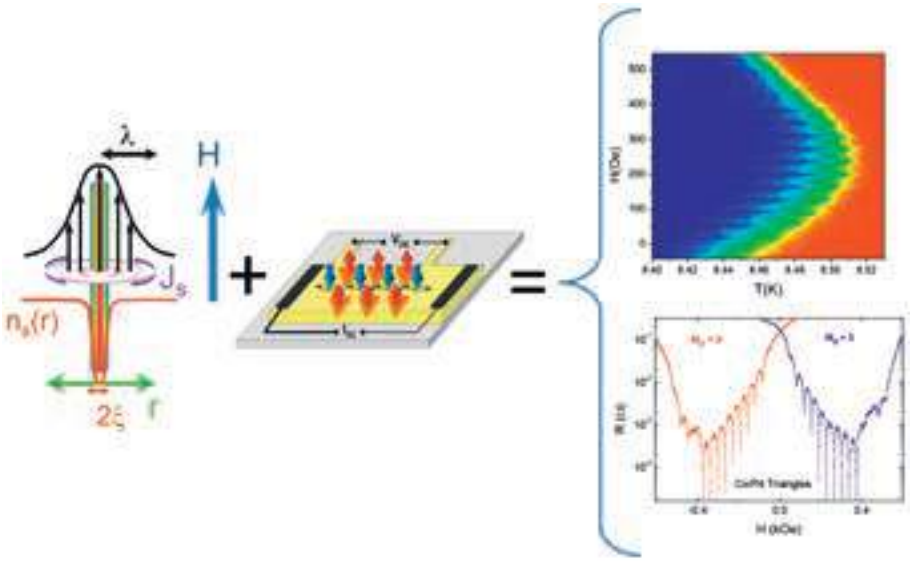
Nanostructured superconductors

Dr. Elvira M. González
Associate Researcher
Ph.D: Universidad Complutense de Madrid
Double Affiliation: Universidad Complutense de Madrid

Elvira M. González obtained her PhD in Physics from Universidad Complutense de Madrid (UCM) in 1998 with a work on high–Tc 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 magnetotuneling 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 Fisicas (UCM) to work in the fabrication of ordered nanostructures. Currently, she is Associated Professor in the Departamento de Fisica 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

Programe Manager: Prof. Julio Camarero

SpinOrbitronics
Dr. Paolo Perna

Hard Magnetic Materials
Dr. Alberto Bollero

Advanced Magneto-Optics
Prof. Julio Camarero

Epitaxial Growth
Dr. Miguel Ángel Niño

Growth & Nanostructuring
Dr. Feng Luo

Dynamics
Dr. Francisco Terán

Advanced Magneto-Optics

Prof. Julio Camarero
Associate Research Professor
PhD: Universidad Autónoma de Madrid, Spain
Double Affiliation: Universidad Autónoma de Madrid, Spain
ORCID: http://orcid.org/0000-0003-0078-7280
Researcher ID: 7005397955

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 magnetoresitive 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.

Growth & Nanostructuring

Prof. Feng Luo
Senior Research Prof.
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

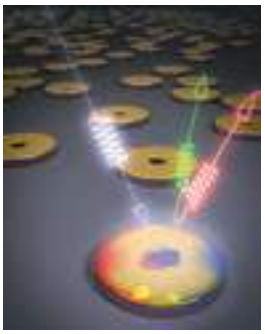
The group has varied interests in the nanofabrication and 2D devices. In particular we are active in:

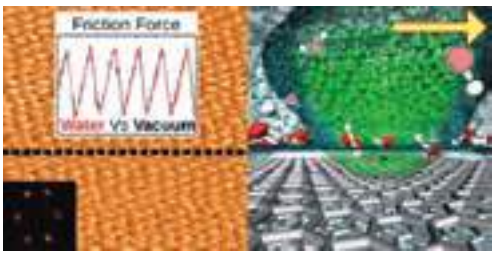
1. Nanomagnetism and spintronics:
   a) Low dimensional magnetic nanocrystalline materials and bit patterned magnetic recording media for ultra-high density magnetic recording.
   b) Correlation between the microstructure and magnetic properties in hard magnetic thin film materials for magnetic head.
   c) Magnetostric/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.

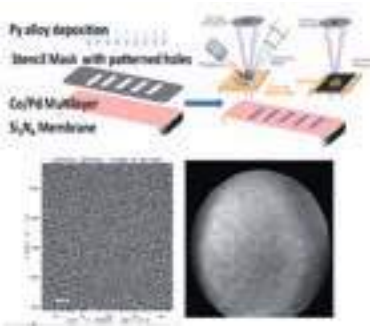
Hauyu Feng
Ph. D. student
Beijing Normal University, China

Ynasheng Liu
Ph. D. student
Lanzhou University, China

Liu Zhao
Ph. D. student
China Building Materials Academy, China







Epitaxial Growth

Dr. Miguel Ángel Niño
Assistant Research Prof. (tenure track)
Ph.D.: Universidad Autónoma de Madrid, Spain
Previous Position: Elettra Synchrotron Radiation Facility (Trieste), Italy
Researcher ID: http://www.researcherid.com/rid/M-2571-2014

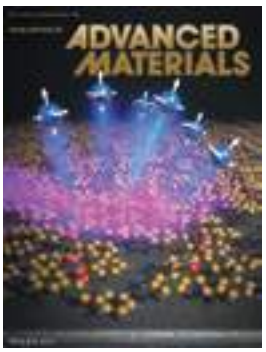
Miguel Angel Niño obtained his MSc (1997) in Solid State Physics from the Universidad Autónoma de Madrid (UAM). He joined in 2000 the group of Prof. R. Miranda at the Surface Science Laboratory of UAM where he obtained his PhD in 2006. He then moved to the group of Prof. Maya Kiskinova and A. Locatelli 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.

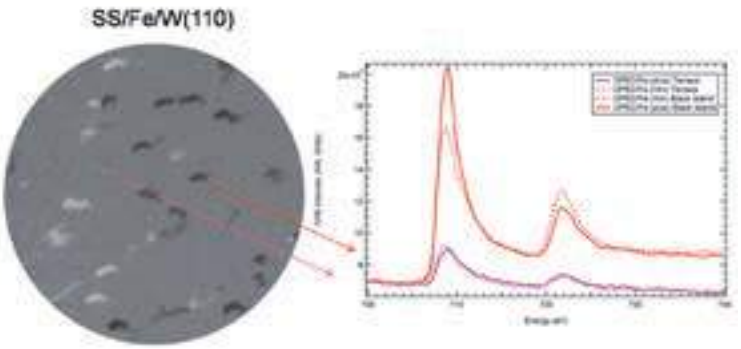
Research Lines

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:

Fernando Ajejas
Ph.D. student

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.





SpinOrbitronics

Dr. Paolo Perna
Assistant Research Prof. (tenure track)
Ph.D.: University of Caen Basse- Normandie, France & University of Cassino, Italy
Previous Position: CNR-SPIN,Italy
Researcher ID: http://www.researcherid.com/rid/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 is mostly dedicated to the understanding and realization of novel spintronics and spin-orbitronic devices by employing materials with tailored interface functionalities.

Dr. Rubén Guerrero
Postdoc
Institut d'Electronique Fondamentale (IEF) Universite Paris- Sud, France

Sergio de las Heras
Technician

Adrian Gudín (UAM)
Internship

Jaime Ramos (UPM)
Internship

Victor Marzoa (UPM)
Internship

Sandeep Kumar Chaluvadi
Visiting Ph.D. student.
Université de Caen – ENSICAEN, France

Saba Shojaie Mehr
Visiting Ph.D. student.
Kashan University, Iran.

SpinOrbitronics

Research Lines

The group activities cover both fabrication and characterization of magnetic and non-magnetic systems focusing on their fundamental properties and potential technological applications.

Research Lines

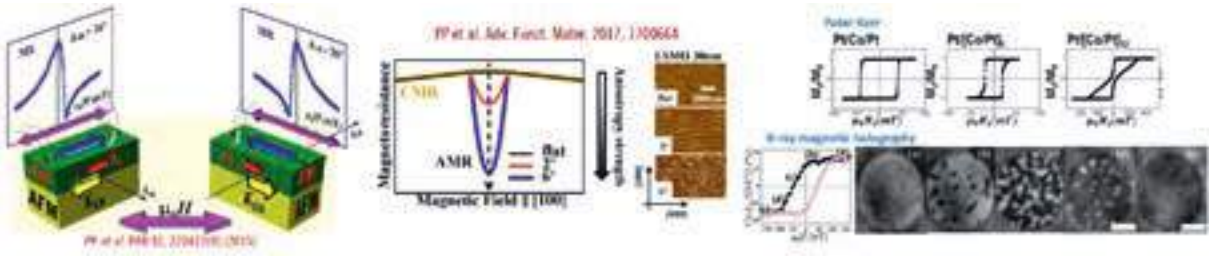
The group activities cover both fabrication and characterization of magnetic and non-magnetic systems focusing on their fundamental properties and potential technological applications.

1. **Spin-Orbitronics Functional Interfaces. Disentangling magnetoresistance responses in magnetic nanostructures:** magnetization reversal vs. spin-dependent transport; magnetic anisotropies (in-plane vs. perpendicular). *Phys. Rev. B,* **92**, 220422(R) (2015); *Phys. Rev. B,* **86**, 024421 2012); *Appl. Phys. Lett.* **104**, 202407 (2014); *AIP Advances* **6**, 055819 (2016).

2. **Novel hybrid (inorganic-organic) magnetic nanostructures:** growth of artificial magnetic nanostructures; surface/interface analysis; graphene-based magnetic nanostructures. *Chem. Mater.* **26**, 2883-2890 (2014); *Nano Lett.* **16**, 2-7 (2016).

3. **Element and spatial resolved X-ray spectroscopy and microscopy:** X-ray magnetic circular/linear dichroism (XMCD/XMLD), resonant magnetic reflectivity (XRMR), holography. *J. Appl. Phys.* **109** (7), 07D357 (2012).

4. **Oxide spintronics:** half-metallic, ferroelectric and multiferroic perovskites. *Appl. Phys. Lett.* **97**, 152111 (2010). *J. Appl. Phys.* **110**, 013919 (2011); *Adv. Optical Mater.* 2013, **1**, 834-843; *Adv. Mater.* 2012, **24**, 3952-3957; *New Journal of Physics* **12**, 103033 (2010).



program

nanoscience for critical raw materials

Programe Manager: Prof. Alberto Bollero

Rare-Earth free Permanent Magnets
Dr. Alberto Bollero

Energy Harvesting
Dr. Juan Cabanillas-González

Multifunctional Materials

Recycling

Nanoscience for critical raw materials

Prof. Alberto Bollero
Senior Research Professor & Head of Division of Permanent Magnets and Applications
Ph.D.: Technical University of Dresden, Germany
Previous Position: CIEMAT, Spain
http://orcid.org/0000-0002-3282-0981
Researcher ID: 6602946322
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 o 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 involving companies with 7 projects with the researcher as Coordinator during last 3 years. These projects position A. Bollero as P.I. on research and industrial projects that total over 5.5 M€. He has above 70 publications in peer reviewed journals and contributions to more than 90 international scientific conferences. A. Bollero has obtained 2 Awards in International Conferences, 2 patents and 3 additional ones under application.

Very recently he has been invited speaker at 2015 MRS Fall Meeting (Boston, USA), 2016 E-MRS (Lille, France), 2016 EMN Meeting (Croatia) and 2017 ICCE-25 (Rome) to present latest advances, applications and recycling of rare earth-free permanent magnets.

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

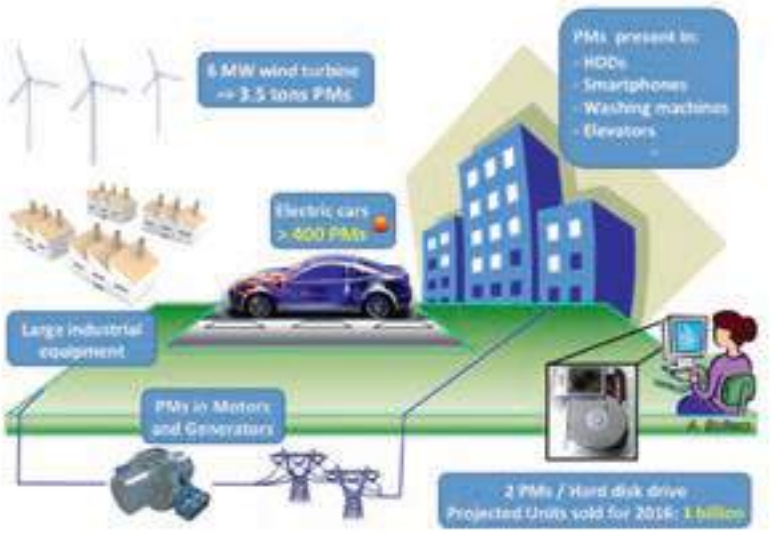
Francisco Javier Pedrosa
Ph. D. student

Javier Rial
Ph. D. student

Melek Villanueva
Ph. D. student

Noelia Lopez
Technician

Dr. Cristina Navio
Postdoc
Mons University, Belgium



program
nanomedicine

Programe Manager: Prof. Rodolfo Miranda

Synthesis of magnetic nanoparticles
Dr. Gorka Salas

NanoOncology
Dr. Cristóbal Belda M.D.
Dr. Ángel Ayuso

Tecnological and biomedical applications of magnetic nanoparticles
Dr. Francisco Terán

Metallodrugs
Dr. Ana Pizarro

Applied Nanomagnetics
Dr. Daniel Ortega

Nucleic Acids and Nanoparticles in Nanomedicine
Prof. Álvaro Somoza

Nucleic Acids and Nanoparticles in Nanomedicine

Prof. Álvaro Somoza
Senior Research Prof.
Ph.D.: Universidad Autónoma de Madrid, Spain
Previous Position: Instituto de Investigaciones Biologicas (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

Ana Belén Latorre
Ph.D. student

Catarina Castanheira Coutinho
Visiting Ph.D. student.
Erasmus Programme.
Institute of Biomedical Sciences Abel Salazar of the University of Porto, Portugal

Diana Gracheva
Visiting Ph.D. student.
Erasmus Programme.
Samara State Aerospace University. URSS. Erasmus Programme

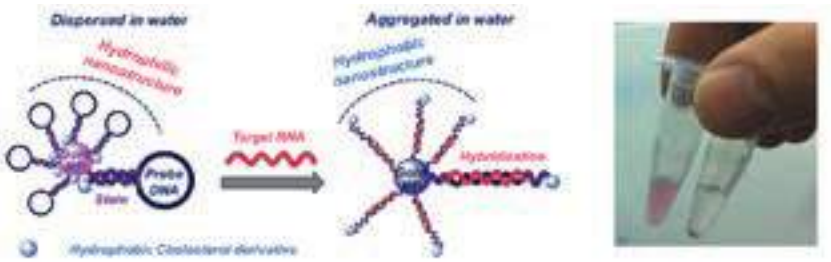
Christian Fernando Duarte (UFV)
Internship

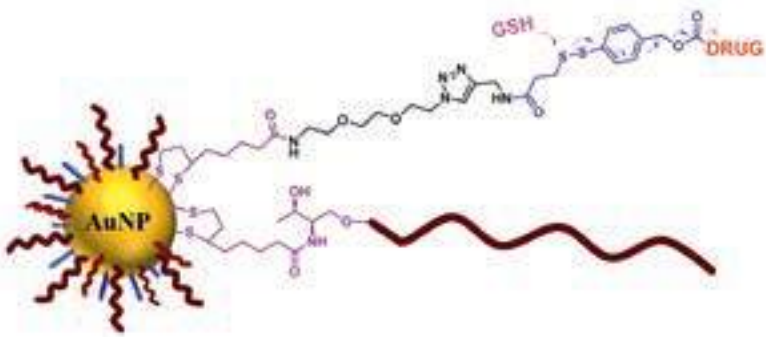
Juan Martínez Rodríguez (UPM)
Internship

Nucleic Acids and Nanoparticles in Nanomedicine

Relevant Publications

- Modified RNAs in CRISPR/Cas9: An Old Trick Works Again. *Angew. Chem. Int. Ed.* **55**, 3548-3550 (2016).
- Antibacterial Activity of DNA-Stabilized Silver Nanoclusters Tuned by Oligonucleotide Sequence. *ACS Appl. Mater. Interfaces,* **8**, 10147-10154 (2016).
- Multifunctionalized iron oxide nanoparticles for selective drug delivery to CD44-positive cancer cells. *Nanotechnology* **27**, 65103 (2016).
- Efficient treatment of breast cancer xenografts with multifunctionalized iron oxide nanoparticles combining magnetic hyperthermia and anti-cancer drug delivery. *Breast Cancer Res.* **17**, 1-17 (2015).
- DNA and aptamer stabilized gold nanoparticles for targeted delivery of anticancer therapeutics. *Nanoscale* **6**, 7436-42 (2014).
- Single-point mutation detection in RNA extracts using gold nanoparticles modified with hydrophobic molecular beacon-like structures. *Chem. Commun.* **50**, 3018 (2014).





Tecnological and Biomedical Applications of Magnetic Nanoparticles

Dr. Francisco Terán
Research Prof.
Ph.D.: Universite Joseph Fourier-Grenoble I, France
Previous Position: Centro Tecnologico Gaiker.Fundacion Gaiker. Spain
ORCID: 0000-0002-2466-6208
Researcher ID: http://www.researcherid.com/rid/F-1285-2010

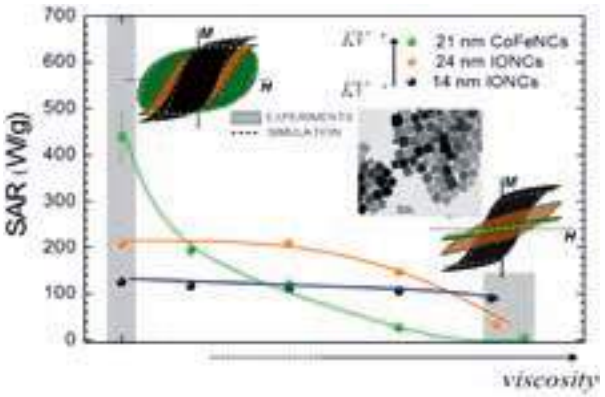
Francisco J. Terán obtained his PhD in Physics (November 2001) at Université Joseph Fourier in Grenoble (France) under supervision of Prof. Marek Potemski. Then, Dr. Teran realized different postdoctoral stays at the Quantum Transport group at the University of Nothingham working with Prof. Laurence Eaves, back to Grenoble High Magnetic Field Lab CNRS-MPI/FKF, SemicUAM group at the Universidad Autónoma de Madrid working with Prof. José Manuel Calleja (Juan de la Cierva fellow). On March 2007, Dr. Teran joined IK4-Gaiker Technological Center as Senior researcher (2008 Torres Quevedo fellowship). On April 2009, Dr. Terán joined IMDEA Nanociencia (2012-2017 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 is leading the Hyperthermia Lab and since 2014 the Advanced Instrumentation Service.

Research Lines

The Hyperthermia Lab focuses his research activities on the physical phenomena oriented to biomedical application which are related to dynamical magnetic response of magnetic nanoparticles when subjected to alternating magnetic fields. In particular, we are highly interesting in:

1. The study of the influence of intrinsic (size, chemical composition) and extrinsic (biological matrix, field conditions, aggregation, concentration, viscosity, etc..) parameters on the AC magnetic response (including magnetic heating) of magnetic nanoparticles (Cabrera et al. Nanoscale 2017).

2. Unveiling the physical mechanisms related to photothermal response of magnetic nanoparticles.



David Cabrera
PhD student

Emilio Artés
Technician

David Sigüenza
Research assistant

Aidin Lak and Mikhail V. Zyuzin
Visiting PhD students.
Istituto Italiano di Tecnologia
Genova, Italy

Internships

Francisco Buendía (UAM)

Javier Retortillo (UAM)

Ander Urien (UAM)

Nicole Arthur (UPM)

Elena Campillo (UCM)

Elena Plaza (UCM)

Tecnological and Biomedical Applications of Magnetic Nanoparticles

3. The study of the influence of biological matrices and fluids on the AC magnetic response of magnetic nanoparticles (Aires et al. Chem.Nano.Mat 2016).

4. The use of magnetic nanoparticles as magnetic transducer for sensing molecular markers in biological fluids.

5. The development and validation of instrumentation for advanced magnetic measurements (HYPERLINK "https://sites.google.com/site/servin-" https://sites.google.com/site/servinsimdeanano/home).

Relevant Publications

- Effects of inter- and intra-aggregate magnetic dipolar interactions on the magnetic heating efficiency of iron oxide nanoparticles *Phys. Chem. Chem. Phys.* **18**, 10954 (2016).

- Controlled synthesis of uniform magnetite nanocrystals with high-quality properties for biomedical applications *J. Mater. Chem.* **22**, 21065 (**2012**).

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: http://www.researcherid.com/rid/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 Organométallique 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

Internships

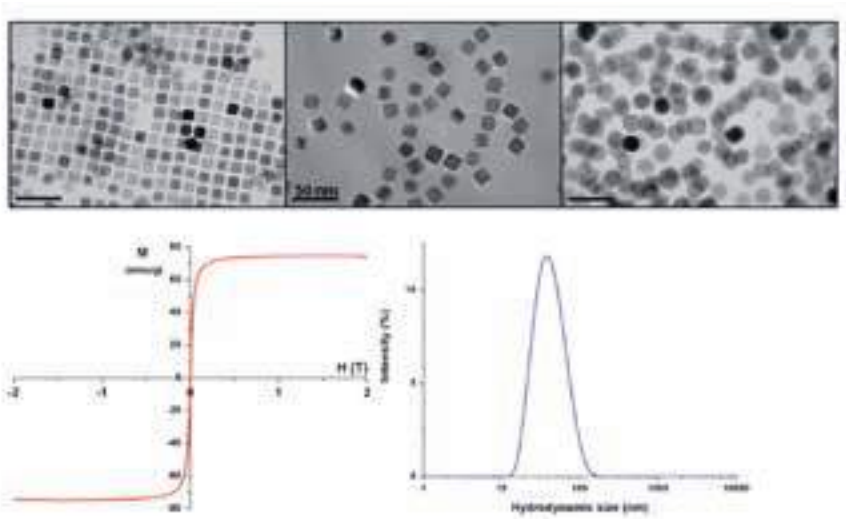
David García (UAM)

Laura González (UC3M)

Roberto del Río (UAM)

María Vacas (UAM)

Marcos Zan (UAM)



Hyperthermia

Dr. Daniel Ortega
Assistant Research Prof. (tenure track)
Ph.D.: University of Cadiz, Spain
Previous Position: University College London. United Kingdom
ORCID: http://orcid.org/0000-0002-7441-8640
Researcher ID: http://www.researcherid.com/rid/D-7940-2012

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 laboratory. He joined IMDEA Nanoscience in 2013 through a Marie Curie action, also holding an honorary position at the UCL Institute of Biomedical Engineering. Daniel currently belongs to the Spanish National Centre for Biotechnology (CNB)-IMDEA Nanoscience Associated Unit.

Carmen Doblado
PhD student

Internships

Elena González López-Aranda (UCM)

Sergio Montero (UCM)

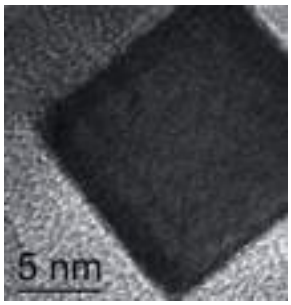
Research Lines

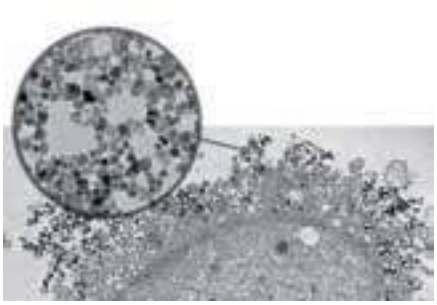
The group is focused in bespoke magnetic nanoparticles with applications in biomedicine. More specifically:

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, brain imaging contrasts, and magnetic particle imaging tracers.

3. Computational electromagnetism and *in silico* clinical trials. Starting from animal and human computable phantoms, we perform computer simulations of therapies and diagnostic techniques based on the interaction of electromagnetic fields and nanomaterials.





Metallodrugs

Dr. Ana Pizarro
Assistant Research Prof. (tenure track)
Ph.D.: Universidad Autónoma de Madrid, Spain
Previous Position: University of Warwick (UK)
Name of P.I.: Ana M. Pizarro
ORCID: orcid.org/0000-0003-3037-9835
Researcher ID: http://www.researcherid.com/rid/L-8348-2014

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 metallodrugs (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.

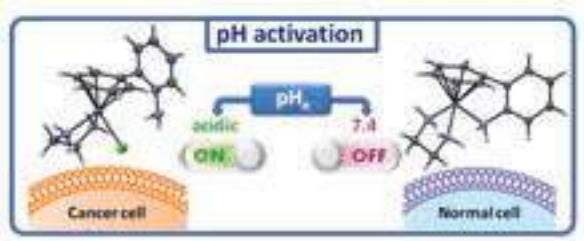
Research Lines

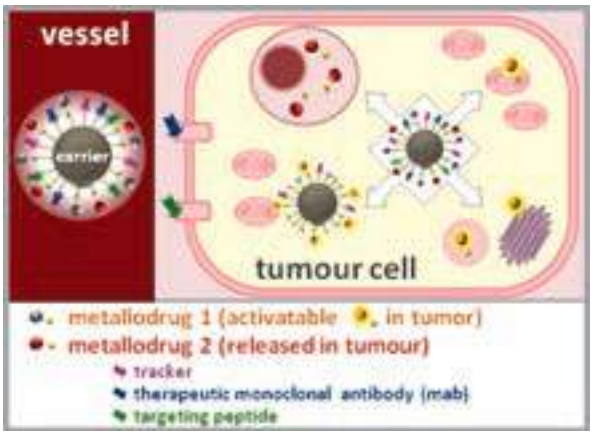
- Our ultimate goal is to generate metal-based drugs whose mechanism of action is understood and whose targets are identified. These metallo-medicines will exploit the extraordinary features of transition metal complexes, in particular the capability for in tumour activation (for example, pH-responsive 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

Ana C. Carrasco
Ph.D. student





Magnetic Nanoparticles in Biomedicine. Cell-particle Interactions

Prof. Ángeles Villanueva
Associate Research Prof.
Ph.D.: Universidad Autónoma de Madrid, Spain
Double Affiliation: Universidad Autónoma de Madrid, Spain

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 stud ied in cell cultures: i) the mechanisms of nanoparticles internalization; ii) their subcellular localization; iii) the nano- particles biocompatibility; and iv) the identification the cell death mechanism induced by heatcontrolled intracellular hyperthermia with magnetic nanoparti- cles and an alternating magnetic field.

Research Lines

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

Macarena Calero
Ph .D. student

Engineering Biofunctional Nanostructures

Dr. Aitziber L. Cortajarena
Associate Research Prof.
Ph.D.: Universidad del Pais Vasco, Spain
Double Affiliation: Biomateriales-CIC-biomaGUNE, San Sebastián, 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 biofunctional 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 Nanotecnology 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.

Sara H. Mejías
Ph.D. student

David Romera
Ph.D. student

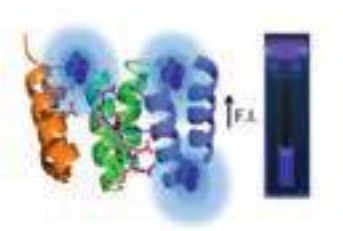
Elena López (UAM)
Internship

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).



NanoOncology

Dr. Ángel Ayuso-Sacido
Associate Researcher
Ph.D.: Merck Sharp and Dhome
Double Affiliation: Fundación Hospitales de Madrid, Madrid, Spain
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 come back to Spain and worked as Senior Researcher at Centro de Investigacion Principe 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 Quimica Avanzada de Cataluna (IQAC-CSIC)
Barcelona, Spain

Dr. Gorjana Rackov
Postdoc
Centro Nacional Biotecnología (CNBCSIC), Madrid, Spain

Dr. Carmen González Tejedo
Postdoc
Centro Nacional Biotecnología (CNBCSIC), Madrid, Spain

Noemí García
Ph.D. student

program
nanobiosystems

Programe Manager: Prof. J.L. Carrascosa

Optical Nanomanipulation
Dr. Ricardo Arias-González

Advanced Fluorescence Nanoscopy
Dr. Cristina Flors

Protein Engineering
Dr. Begoña Sot

Molecular Motors Manipulation
Dr. Borja Ibarra

Mechanical properties of Biostructures
Dr. Johann Mertens

Protein Biophysics
Prof. Víctor Muñoz

Nanobiosystems

Prof. J.L. Carrascosa
Associate Research Prof.
PhD: Universidad Complutense de Madrid, Spain
Double Affiliation: Unidad de Nanobiotecnología. Joint Unit IMDEA Nanociencia-CNB-CSIC
Researcher ID: 35481302900

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 Biotecnologia. 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 in Molecular and Cell Biophysics

Dr. Ricardo Arias-González
Assistant Research Prof. (tenure track)
Ph.D.: Universidad Complutense de Madrid, Spain
Previous Position: Centro Nacional Biotecnologia (CNB-CSIC), Madrid, Spain
ORCID: http://orcid.org/0000-0001-6802-0874
Researcher ID: http://www.researcherid.com/rid/L-8538-2014
www.ariasgonzalez.com/home.html

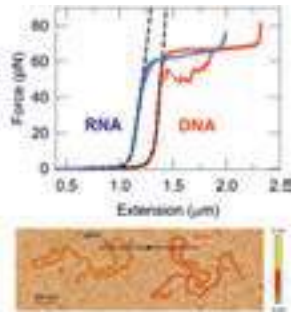
J. Ricardo Arias-Gonzalez received both his Master Degree in Theoretical Physics in 1997 and his Ph.D. in 2002 from Complutense University in Madrid. During his Ph.D. research in the Materials Science Institute (ICMM-CSIC), Madrid, and short stays in the National Institute of Standards and Technology (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.



Molecular Motors Manipulation

Dr. Borja Ibarra
Assistant Research Prof. (tenure track)
Ph.D.: Universidad Autónoma Madrid, Spain / CNB-CSIC Madrid, Spain
Previous Position: Centro Nacional Biotecnologia (CNB- CSIC), Madrid, Spain
ORCID: http://orcid.org/0000-0001-6597-797X
Researcher ID: http://www.researcherid.com/rid/H-5840-2015
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.

Fernando Cerrón
Ph.D. student

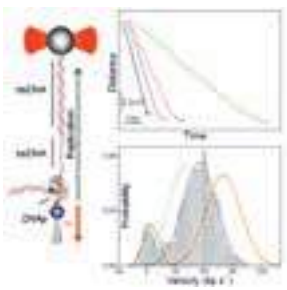
Katerina Lemishko
Ph.D. student

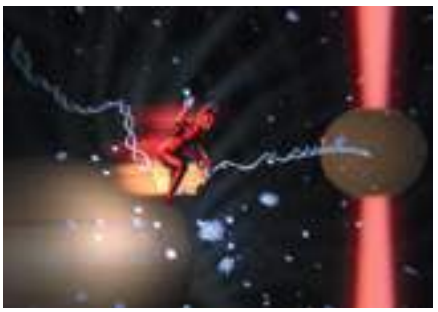
Research Lines

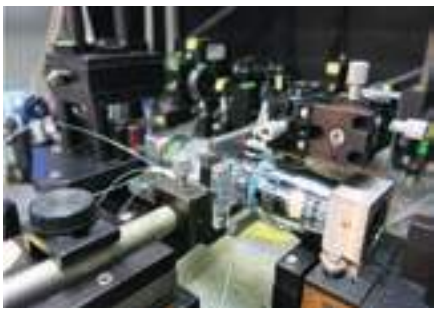
The use of molecular motors to power man-made-nanomachines is one of the most exciting challenges facing nanotechnology. Our laboratory combines single molecule manipulation techniques (optical tweezers) with biochemical, molecular biology and theoretical modelling approaches to unravel the dynamic and mechanistic aspects of operation of biological molecular motors. Using nature as a guide will facilitate the design of efficient man-made- nanomachines for complex operations at the nanoscale.

Our research lines include:

1. Mechano-chemical characterization of biological motors involved in DNA metabolism. (*EMBO J* 2009, *PNAS* 2012, *Cell Cycle* 2012, *Nuc. Acid Res.* 2015, JSAT 2016).
2. Molecular machinery: Characterization of the coordinated activity of molecular motors complexes involved in: *a)* human mitochondrial DNA replication, *b)* membrane fission and *c)* viral RNA-RNA transcription.
3. Synthetic molecular motors: characterization, at the single molecule level, of 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 combine optical manipulation with fluorescence detection and temperature control systems. This exciting marriage of techniques will open up a wealth of new promising applications.







Advanced Fluorescence Nanoscopy

Prof. Cristina Flors
Senior Research Prof.
PhD: Institut Quimic de Sarria, Spain
Previous Position: University of Edinburgh, Edinburgh, UK
ORCID: http://orcid.org/0000-0001-5688-9150
Researcher ID: http://www.researcherid.com/rid/C-2123-2017
Group webpage: http://imdeananotools.wix.com/flors

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, it was shown that 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 on the improvement of super-resolution fluorescence microscopy, and its application to study biology and materials. She is also interested in the development and characterization of novel fluorescent proteins for advanced microscopy applications.

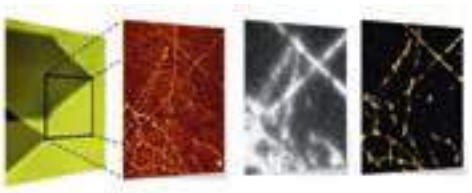
Dr. Alberto R. Pulido
Postdoc
Groningen University, The Netherlands

Patricia Bondía
Ph.D. student

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
Assistant Research Prof. (tenure track)
PhD.: Universidad del País Vasco, Spain
Previous Position: Centro Nacional Biotecnología (CNBCSIC), Madrid, Spain
ORCID: orcid.org/0000-0001-8763-0651

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

Internships

Laura Villar (UAH)

Alejandra Rubio (UAH)

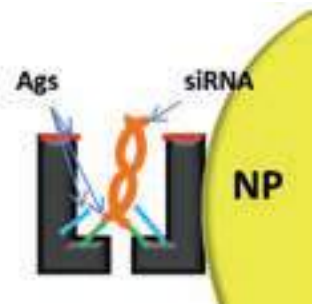
Research Lines

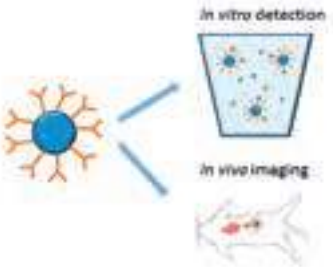
The group has varied interests in proteins and their use as tools in nanomedicine:

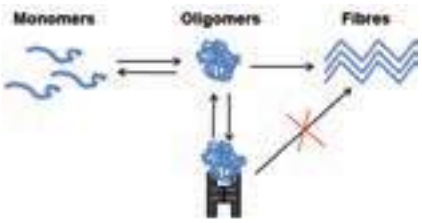
1. Design of new immunotherapy tools based in engineered molecular chaperones and gold nanoparticles able to load Antigen Presenting Cells with antigens and siRNAs for their use in immunotherapy.
2. Mechanism of molecular chaperones inhibition of amyloid fibers assembly.

Relevant Publications

- Molecular chaperones: functional mechanisms and nanotechnological applications *Nanotechnology*. 2016, **27** (32): 324004.







Mechanical Properties of Biostructures

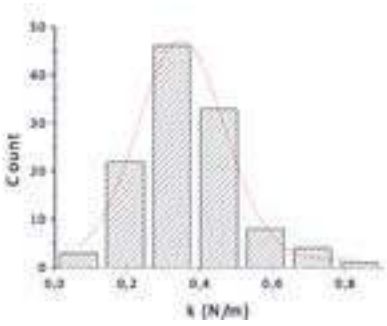
Dr. Johann Mertens
Assistant Research Prof. (tenure track)
PhD.: University of Burgundy, France
Previous Position: Madrid Microelectronics Institute, Spain
ORCID: orcid.org/0000-0002-1312-8914
Researcher ID: http://www.researcherid.com/rid/I-4208-2015

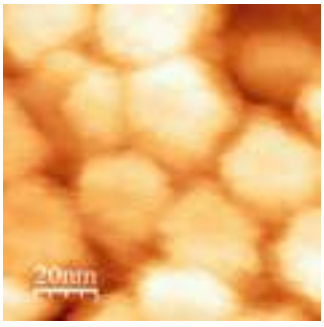
Johann Mertens obtained his BSc (1999) and MSc (2000) in Physics from the University of Bordeaux (FR). He then joined the group of Prof. Eric Finot at the University of Burgundy (FR) where he obtained his PhD in 2003. Then he worked as a research engineer at the French Atomic Energy Commission (CEA) 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.

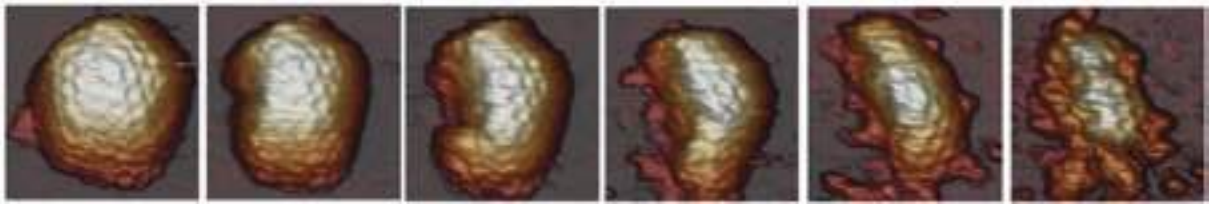
Dr. Javier Chichón
Postdoc
CNB-CSIC, Spain

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

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

Unidad de Nanobiotecnologa Joint Unit: IMDEA Nanociencia-CNBCSIC
Ph.D.: Universidad Autónoma de Madrid, Spain / EMBL-Heidelberg, Germany
Group webpage: HYPERLINK "http://www.cnb.csic.es/index.php/en/research/research-departments/macromolecular-structures/conformational-functional-behaviour-of-proteins" 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

Dr. Popovic Matijda
Postdoc
King's College London, London, UK

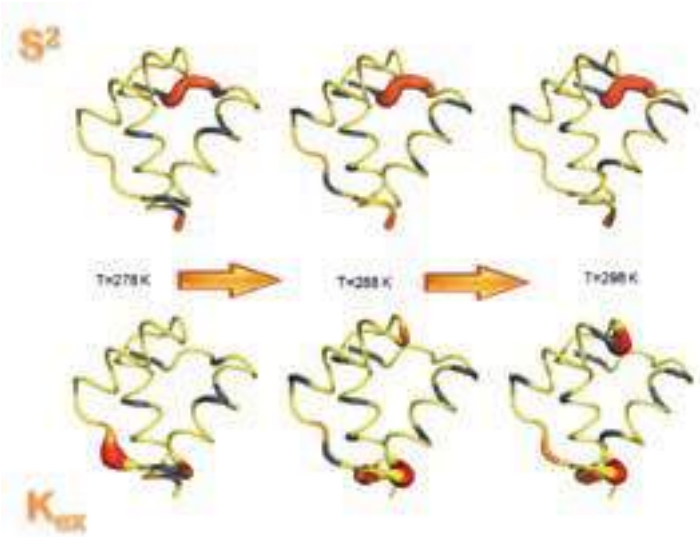
Dr. Veeramuthu Natarajan Sivananda
Postdoc
CICbioGUNE, Bizkaia, Spain

Protein Biophysics

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
Postdoc
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 Madrileno de Estudios Avanzados en Nanociencia (IMDEA-Nanociencia).

program
nanostructured functional surfaces

Programe Manager: Prof. Isabel Rodriguez

Functional Surfaces
Prof. Isabel Rodríguez

Functional Surfaces

Prof. Isabel Rodríguez
Senior Research Professor
PhD: National University of Singapore
Previous Position: Institute of Materials Research and Engineering (IMRE), Singapore
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Isabel Rodriguez graduated in Pharmacy from the University of Alcala 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 jointed 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:

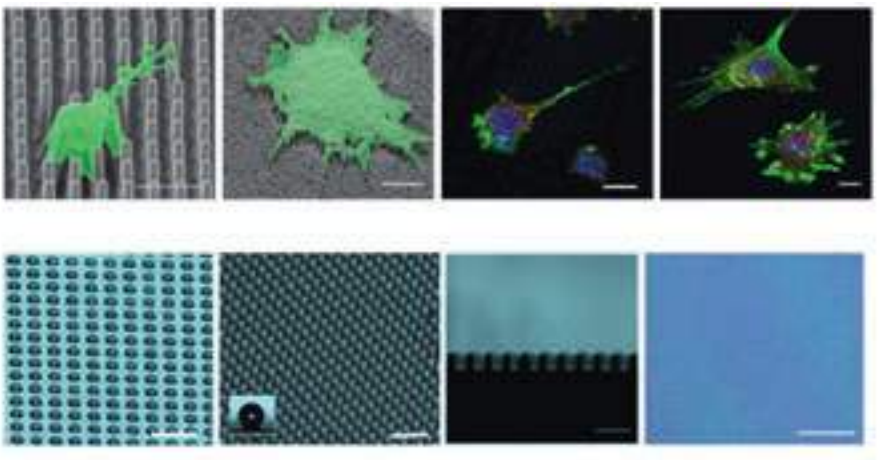
1. Nano-engineered functional surfaces for medical applications, particularly in the development of antibacterial functionalities and cell culture fluidic platforms for cell biomechanical assays.
2. Multifunctional surfaces. We are developing the methodology to impart onto polymer nanocomposites additional 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

Alejandra Jacobo
Technician

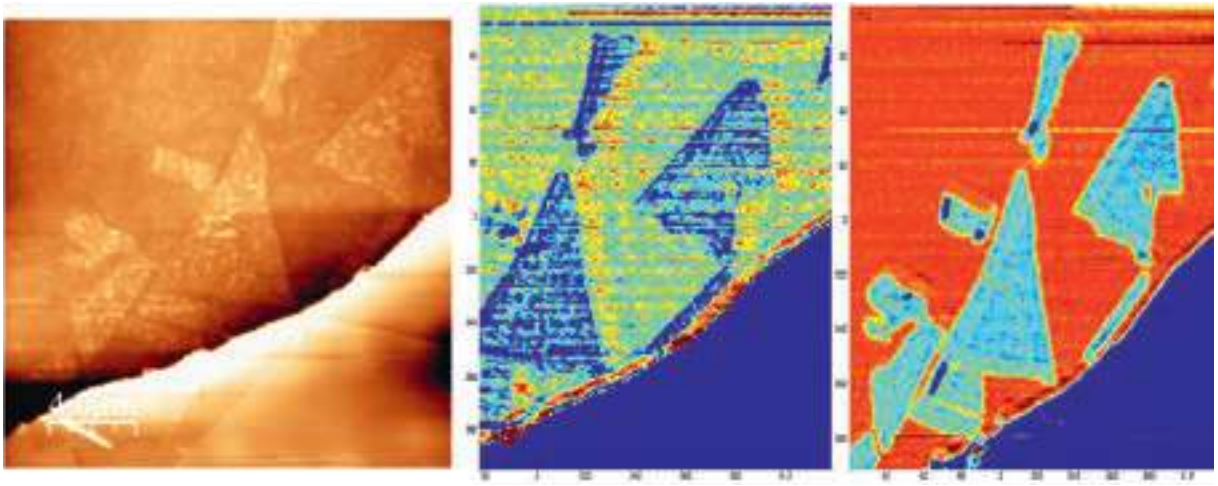


program
quantum nanodevices

Programe Manager: Dr. Daniel Granados

Quantum Devices and Photonics
Dr. Daniel Granados

Superconducting Detectors



Quantum Devices and Photonics

Prof. Daniel Granados
Senior Research Professor
Ph.D.: Universidad Autónoma de Madrid. Spain
Previous Position: Toshiba Research Europe Ltd. (TREL), Cambridge, UK
Researcher ID: http://www.researcherid.com/rid/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.

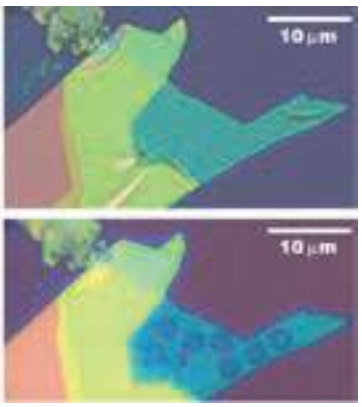
Ramón Bernardo
Ph.D. student

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-electromechanical optical systems. We can also study the near-field response of quantum devices under test, such as GFETs or MoS_2 FETs.



Center for Nanofabrication

Prof. 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 photon- ics 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

Assistant Research Prof. (tenure track)

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

Previous Position: Universidad Complutense de Madrid, Spain

He obtained his Ph.D. in Condensed Matter Physics from Universidad Autonoma de Madrid in Spain in collaboration with Istituto di Cibernetica del CNR in Italy, in 2003. He was post-doc researcher in Istituto di Cibernetica del CNR in Naples, Italy from 2004 to 2007, researcher in Istituto Nazionale per la Fisica della Materia and Istituto Nazionale di Fisica Nucleare in Naples Italy from 2000 to 2004 and grantee researcher in ESTEC European Space Agency in Noordwijk, The Netherlands from 1997 to 1999. His research interests are mainly focused in 2D materials &devices, Superconductivity, Superconducting Detectors, Superconducting Tunnel Junctions, and Science Materials.

He is the scientist responsible of the helium liquefaction plant.

Dr. Manuel Rodríguez

Research staff

Ph. D. Universidad Santiago de Compostela, Spain

Fernando Jiménez

Technician

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RMN and Mass Spec.Services

Dr. Javier López Ogalla
Ph. D. Universidad Autónoma de Madrid, Spain

Optical Tweezers

Dr. Rebeca Bocanegra
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Workshop

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Dr. Santiago Casado
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Nanofabrication Services

Dr. Manuel Rodríguez
Ph. D. Universidad de Santiago, Spain

RMN and Mass Spec. Services

Dr. Zulay Pardo
Ph. D. Universidad Complutense de Madrid, Spain

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D. Bonifacio Vega
General Manager
(since October 2015)

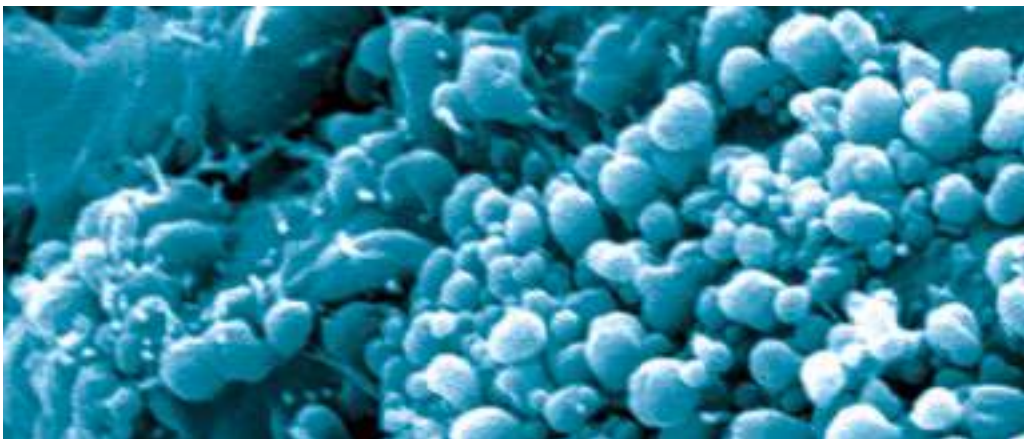
Dª Isabel Rodríguez
MS in Administration,
Administration and Finance
Manager

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

Dr. José Luis Casillas
Facilities & Infrastructure
General Manager

Dr. Mark William Davies
Transfer and Business
Development Assistant

Dr. David Sayago
POCAONTAS Project Manager



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Project Assistant

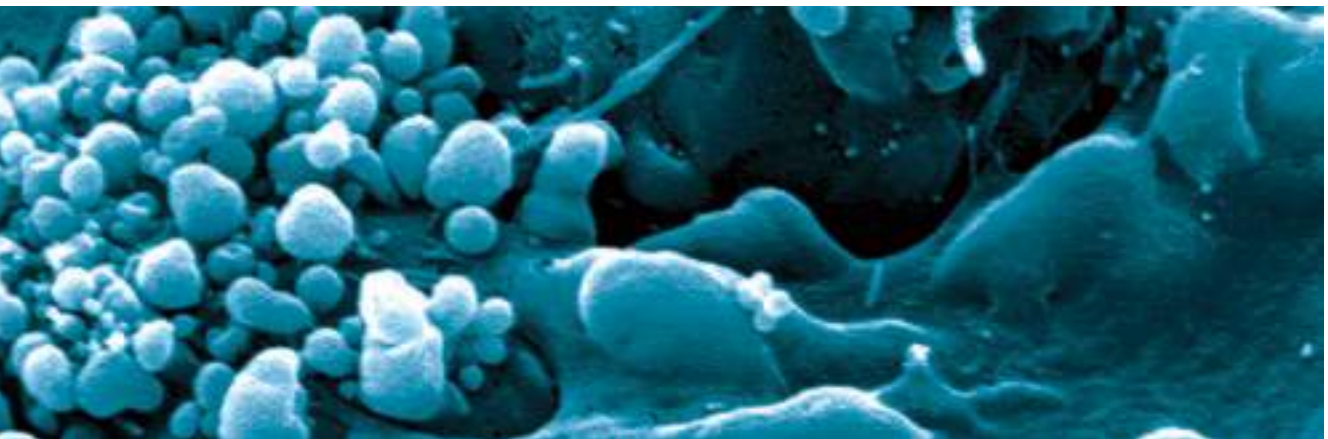
Dª Paloma Macua
Administrative Assistant

Óscar Bodas
Network and Systems Manager

Dª Elena Pérez
Administrative Assistant

Dª Juana Hemoso
Administrative Project Assistant

Dª Paloma Castillo
Director´s Assistant



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3.1. Publications, contributions to books and patents

3.1.1. Publications

1. **Strong luminescent copper (I) halide coordination polymers and dinuclear complexes with thioacetamide and N,N'-donor ligands.** J. Troyano, J. Perles, P. Amo-Ochoa, F. Zamora, S. Delgado *CrystEngComm*, 2016, **18**, 1809-1817. doi:10.1039/c5ce02264a

2. **Luminescent Thermochromism of 2D Coordination Polymers Based on Copper(I) Halides with 4-Hydroxythiophenol.** Troyano J., Perles J., Amo-Ochoa P., Martínez J.I., ConcepciónGimeno M., Fernández-Moreira V., Zamora F., Delgado S. *Chem. Eur. J.* 2016, **22**, 1-10. doi: 10.1002/chem.201603675

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9. **Experimental Evidence of the Origin of Nanophase Separation in Low Hole-Doped Colossal Magnetoresistant Manganites.** Cortés-Gil, R., Ruiz-González, M. L., González-Merchante, D., Alonso, J. M., Hernando, A., Trasobares, S., María Vallet-Regí, Juan M. Rojo González-Calbet, J. M. *Nano Lett.*, 2016, **16** (1), pp 760-765. doi:10.1021/acs.nanolett.5b04704

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13. **Few-Layer Antimonene by Liquid-Phase Exfoliation.** Carlos Gibaja, David Rodriguez-San-Miguel, Pablo Ares, Julio Gómez-Herrero, Maria Varela, Roland Gillen, Janina Maultzsch, Frank Hauke, Andreas Hirsch, Gonzalo Abellµn, and Félix Zamora *Angew. Chem. Int. Ed.* 2016, **55**, 1-6. doi:10.1002/anie.201605298

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15. **Observation of Localized Vibrational Modes of Graphene Nanodomes by Inelastic Atom Scattering.** Maccariello, D., Al Taleb, A., Calleja, F., Vázquez De Parga, A. L., Perna, P., Camarero, J., E. Gnecco, D. Farías, Miranda, R. *Nano Lett.*, 2016, **16** (1), pp 2-7. doi:10.1021/acs.nanolett.5b02887

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19. **Structure, Ionization, and Fragmentation of Neutral and Positively Charged Hydrogenated Carbon Clusters: CnHm q+ (n = 1-5, m = 1-4, q = 0-3).** Sánchez, J. P., Aguirre, N. F., Díaz-Tendero, S., Martín, F., & Alcamí, M. (2016). *J. Phys. Chem. A*, 2016, **120** (4), pp 588-605. doi:10.1021/acs.jpca.5b10143

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22. **Design, synthesis and RAFT polymerisation of a quinoline-based monomer for use in metal-binding composite microfibers.** Anna Isakova, Olga Efremova, Nikki Pullan, Larry Lüer and Paul D. Topham *RSC Adv.*, **2016, 6,** 6598-6606. doi:10.1039/C5RA25551A

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24. **Hierarchical Organization of Organic Dyes and Protein Cages into Photoactive Crystals Joona Mikkilä.** Eduardo Anaya-Plaza, Ville Liljeström, Jose R. Caston, Tomas Torres, Andrés de la Escosura, and Mauri A. Kostiainen *ACS Nano*, 2016, **10** (1), pp 1565-1571. doi:10.1021/acsnano.5b07167

25. **Evidence of charge-remote fragmentation in protonated [60]fulleropyrrolidine multi-adducts.** Dammann C., Bottari G., Torres T., Drewello T. *Int. J. Mass Spectrom,* on line 2016. doi 10.1016/j.ijms.2016.06.009

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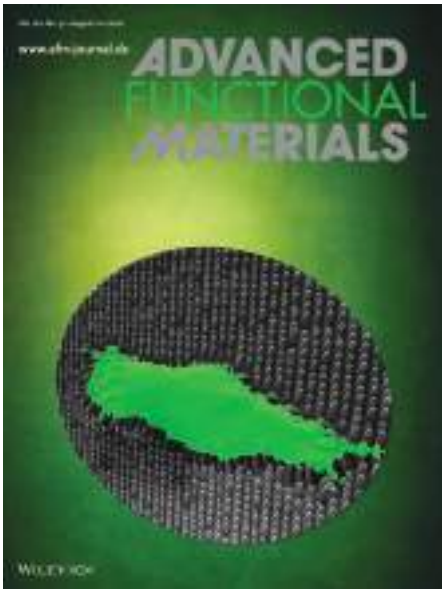
28. **Multifunctionalized iron oxide nanoparticles for selective drug delivery to CD44-positive cancer cells.** Antonio Aires, Sandra M Ocampo, Bruno M Simões, María Josefa Rodríguez, Jael F Cadenas, Pierre Couleaud,Katherine Spence, Alfonso Latorre, Rodolfo Miranda,Álvaro Somoza, Robert B Clarke, José L Carrascosa and Aitziber L Cortajarena *Nanotechnology* **27** (2016) 065103 (10pp). doi:10.1088/0957-4484/27/6/065103

29. **Precise and reversible band gap tuning in single-layer MoSe2 by uniaxial strain.** Island, J. O., Kuc, A., Diependaal, E. H., Bratschitsch, R., Van Der Zant, H. S. J., Heine, T., & Castellanos-Gomez, A. *Nanoscale* 2016, **8**, 2589-2593. doi:10.1039/c5nr08219f



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33. **In Vivo Deep Tissue Fluorescence and Magnetic Imaging Employing Hybrid Nanostructures.** Dirk H. Ortgies, Leonor de la Cueva, Blanca del Rosal, Francisco Sanz-Rodríguez, Nuria Fernández, M. Carmen Iglesias-de la Cruz, Gorka Salas, David Cabrera, Francisco J. Teran, Daniel Jaque, and Emma Martín Rodríguez *ACS Appl. Mater. Interfaces*, 2016, **8** (2), pp 1406-1414. doi:10.1021/acsami.5b10617

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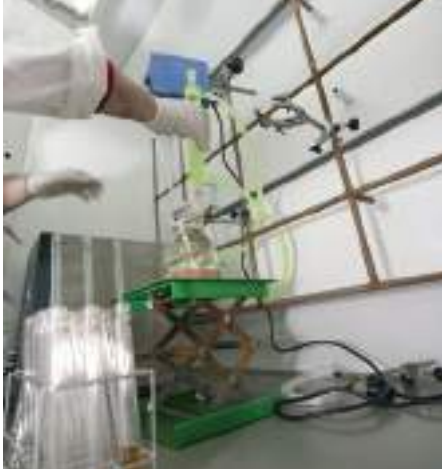

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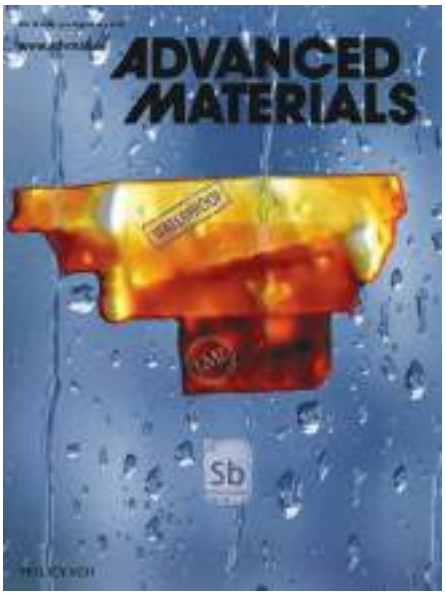

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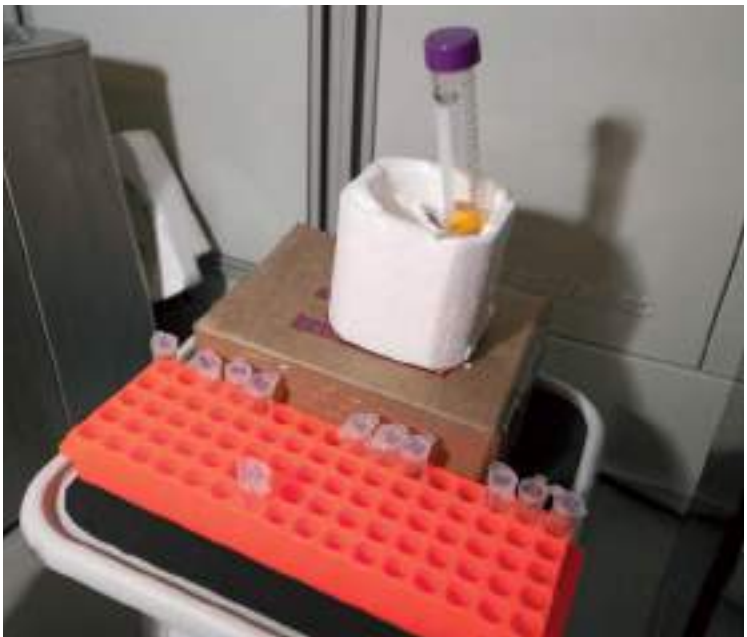

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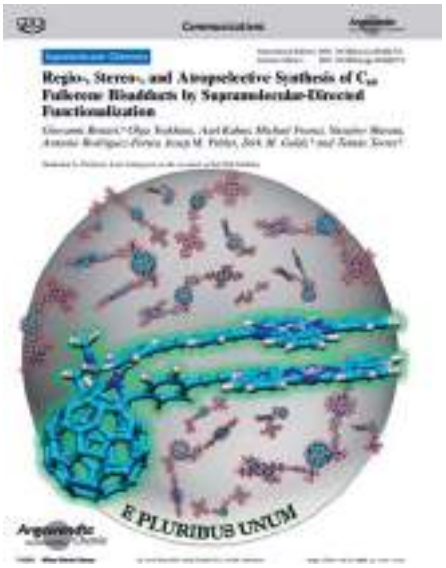

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193. **Conjugated Porphyrin Dimers: Cooperative Effects and Electronic Communication in Supramolecular Ensembles with C60.** Luis Moreira, Joaquín Calbo, Juan Aragó, Beatriz M. Illescas, Iwona Nierengarten, Béatrice Delavaux-Nicot, Enrique Ortí, Nazario Martín, and Jean-François Nierengarten *J. Am. Chem. Soc.*, 2016, **138**, pp 15359-15367. doi:10.1021/jacs.6b07250 cover

194. **Controlling In-Ga-Zn-O thin films transport properties through density changes.** Kaczmarski J., Boll T., Borysiewicz M.A., Taube A., Thuvander M., Law J.Y., Kamińska E., Stiller K. T. *Thin Solid Films* **608** (2016) 57-61. doi:10.1016/j.tsf.2016.04.012

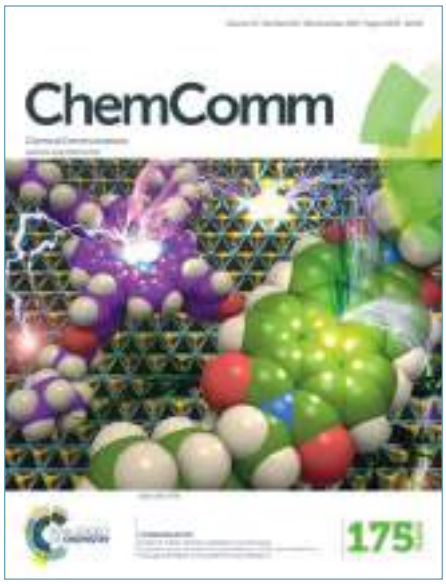
195. **Well-defined, persistent, chiral phthalocyanine nanoclusters: Via G-quadruplex assembly.** García-Iglesias M., Torres T., González-Rodríguez D. *Chem. Commun.,* 2016, **52**, 9446-9449. 10.1039/c6cc04152c

196. **Bimodal Supramolecular Functionalization of Carbon Nanotubes Triggered by Covalent Bond Formation.** S. Leret, Y. Pouillon, S. Casado, C. Navío, A. Rubio, E. M. Pérez *Chem. Sci.,* 2017, **8**, 1927 doi: 10.1039/c6sc03894h.

197. **Cyclooctyne [60]fullerene hexakis adducts: A globular scaffold for copper-free click chemistry.** Ramos-Soriano J., Reina J.J., Pérez-Sánchez A., Illescas B.M., Rojo J., Martín N. *Chem. Commun.,* 2016, **52**, 10544-10546. doi: 10.1039/c6cc05484f

198. **Regioselective preparation of a bis-pyrazolinofullerene by a macrocyclization reaction.** Cuesta V., Urbani M., De La Cruz P., Welte L., Nierengarten J.-F., Langa F. *Chem. Commun.,* 2016, **52**, 13205-13208. doi:10.1039/c6cc06549j

199. **Dysprosium-carboxylate nanomeshes with tunable cavity size and assembly motif through ionic interactions.** Cirera B., Dorević L., Otero R., Gallego J.M., Bonifazi D., Miranda R., Ecija D. *Chem. Commun.,* 2016, **52**, 11227-11230. doi:10.1039/c6cc04874a



200. **Highly Enhanced Fluorescence of Supramolecular Polymers Based on a Cyanostilbene Derivative and Cucurbit[8]uril in Aqueous Solution.** H.-J. Kim, D. R. Wang, J. Gierschner, S. Y. Park, *Angew. Chem. Int. Ed.* 2016, **55**, 15915-15919. doi: 10.1002/anie.201609699

201. **Photochemical site-selective synthesis of [70]methanofullerenes.** Vidal S., Izquierdo M., Law W.K., Jiang K., Filippone S., Perles J., Yan H., Martín N. *Chem. Commun.,* 2016, **52**, 12733-12736. doi: 10.1039/c6cc06072b

202. **Attosecond dynamics through a Fano resonance: Monitoring the birth of a photoelectron.** V. Gruson, L. Barreau, A. Jiménez-Galán, F. Risoud, J. Caillat, A. Maquet, B. Carré, F. Lepetit, J-F. Hergott, T. Ruchon, L. Argenti, R. Taïeb, F. Martín, and P. Salières *Science* **354**, 734-738 (2016). doi: 10.1126/science.aah5188

203. **Engineering the Optoelectronic Properties of MoS2 Photodetectors through Reversible Noncovalent Functionalization.** A. J. Molina-Mendoza, L. Vaquero-Garzon, S. Leret, L. de Juan-Fernández, E. M. Pérez and A. Castellanos-Gomez *Chem. Commun.* 2016, **52**, 14365. doi: 10.1039/C6CC07678E

204. **Information management in DNA replication modeled by directional, stochastic chains with memory.** J. Ricardo Arias-Gonzalez *J. Chem. Phys.* **145**, 185103 (2016) http://aip.scitation.org/doi/10.1063/1.4967335

205. **Atomically resolved phase transition of fullerene cations solvated in helium droplets.** M. Kuhn, M. Renzler, J. Postler, S. Ralser, S. Spieler, M. Simpson, H. Linnartz, A.G.G.M. Tielens, J. Cami, A. Mauracher, Y. Wang, M. Alcamí, F. Martín, M.K. Beyer, R. Wester, A. Lindinger & P. Scheier *Nature Communications* **7**, 13550 (2016). doi: 10.1038/ncomms13550

206. **Resonant Energy Transport in Dye-Filled Monolithic Crystals of Zeolite L - Modeling of Inhomogeneity.** L. Viani, A. Minoia, J. Cornil, D. Beljonne, H.-J. Egelhaaf, J. Gierschner, *J. Phys. Chem. C,* 2016, **120** (48), pp 27192-27199. doi: 10.1021/acs.jpcc.6b10038

207. **In-situ particles reorientation during magnetic hyperthermia application: Shape matters twice.** Konstantinos Simeonidis, M. Puerto Morales, Marzia Marciello, Makis Angelakeris, Patricia de la Presa, Ana Lazaro-Carrillo, Andrea Tabero, Angeles Villanueva, Oksana Chubykalo-Fesenko & David Serantes *Sci. Rep.* **6**, 38382 (11pp) (2016). doi: 10.1038/srep38382

208. **Mechanically controlled quantum interference in individual Ï-stacked dimers.** Frisenda R., Janssen V.A.E.C., Grozema F.C., Van Der Zant H.S.J., Renaud N *Nature Chemistry,* **8**, 1099-1104 (2016). doi: 10.1038/nchem.2588

209. **Highly responsive UV-photodetectors based on single electrospun Ti02 nanofibres** Molina-Mendoza, A.J. Moya, A. Frisenda, R., Svatek, S.A., Gant, P. Gonzalez-Abad, S., Antolin, E., Agraït, N. Rubio-Bollinger, G. Perez de Lara, D. Vilatela, J.J. Castellanos-Gomez, A.*J. Mater. Chem. C,* **4** (2016) 10707-10714 doi: 10.1039/c6tc02344d

contributions to books

3.1.2. Contributions to books

1. "Singlet Oxygen: Applications in Biosciences and Nanosciences", volumes I and II Comprehensive Series in Photochemical & Photobiological Sciences, Royal Society of Chemistry, editors Santi Nonell and Cristina Flors. http://pubs.rsc.org/en/content/ebook/978-1-78262-038-9#!divbookcontent

2. "Protein design for nanostructural engineering: General aspects", Grove T.Z., Cortajarena A.L. in A.L. Cortajarena, T.Z. Grove (eds.), Protein-based Engineered Nanostructures, Advances in Experimental Medicine and Biology 940, pp 1-5. Springer International Publishing Switzerland 2016. doi: 10.1007/978-3-319-39196-0_1

3. "Designed Repeat Proteins as Building Blocks for Nanofabrication", Sara H. Mejias, Antonio Aires, Pierre Couleaud, and Aitziber L. Cortajarena in A.L. Cortajarena, T.Z. Grove (eds.), Protein-based Engineered Nanostructures, Advances in Experimental Medicine and Biology 940, pp 61-81 Springer International Publishing Switzerland 2016. doi: 10.1007/978-3-319-39196-0_4

4. "Protein design for nanostructural engineering: Concluding remarks and future directions", Grove T.Z., Cortajarena A.L. in A.L. Cortajarena, T.Z. Grove (eds.), Protein-based Engineered Nanostructures, Advances in Experimental Medicine and Biology 940, pp 281-284. Springer International Publishing Switzerland 2016. doi: 10.1007/978-3-319-39196-0_12

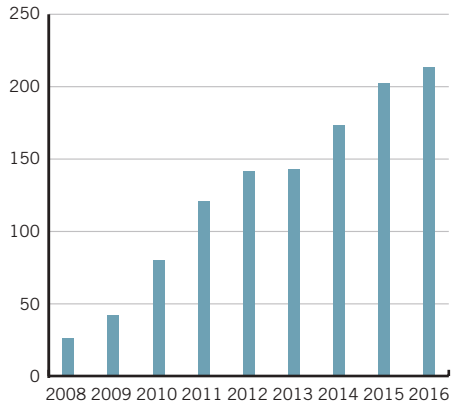
3.1.3. Patents

N	Title	Publication number	Publication date	Inventor(s)	Applicant(s)	
1	Position-sensitive photodetector, method for obtaining same and method for measuring the response from the photodetector	ES2384766 (A1); ES2384766 (B1)	2012-07-12	Cabanillas Gonzalez Juan [ES] Campoy Quiles Mariano [ES]	Fundación IMDEA Nanociencia [ES] Consejo superior Investigación	
2	Position-sensitive photodetector, method for obtaining same and method for measuring the response from the photodetector	EP2650939 (A1)	2013-10-16	Cabanillas Gonzalez Juan [ES] Campoy Quiles Mariano [ES]	Fundacion IMDEA Nanociencia [ES] Consejo Superior Investigacion [ES]	
3	Graphene dried powder and method for its preparation	WO2015014862 (A1)	2015-02-05	Miranda Soriano Rodolfo [ES] Zamora Abanades Félix Juan [ES] Mas-Ballesté Rubén [ES] Azani Mohammad-Reza [ES] Carcelén Valero Verónica [ES] Castellano Doblaré Manuel [ES]	Fundación IMDEA Nanociencia [ES] Univ Autónoma de Madrid [ES] Abengoa Res S L [ES]	
4	Method for the synthesis of covalent organic frameworks	WO2015015035 (A1)	2015-02-05	Zamora Abanades Félix Juan [ES] Mas-Ballesté Rubén [ES] Rodríguez San Miguel David [ES] Segura Castedo José Luis [ES] De La Peña Ruigómez Alejandro [ES]	Fundación IMDEA Nanociencia [ES] Univ Autónoma de Madrid [ES] Univ Madrid Complutense [ES]	
5	Production of corrugated and porous graphene from cof for the use thereof as supercapacitors	ES2538604 (A1); ES2538604 (B1)	2015-06-22	Coronado Miralles Eugenio [ES] Ribera Hermano Antonio Luis [ES] Abellan Saez Gonzalo [ES] Zamora Abanades Félix [ES] Mas Balleste Rubén [ES] Rodriguez San Miguel David [ES]	Uni de València [ES] Univ Madrid Autonoma [ES] Fundación IMDEA Nanociencia [ES]	
6	Detection and treatment of gnaq mutant uveal melanoma cells with gold nanoparticles	WO2015116502 (A1)	2015-08-06	Urda Susana Ortiz [US] Somoza Calatrava Alvaro [ES] Latorre Lozano Alfonso [ES] Posch Christian [US]	Univ California [Us] Fundacion IMDEA Nanociencia [ES]	
7	Modified solid support for the synthesis of oligonucleotides	US2016075680 (A1)	2016-03-17	Somoza Calatrava Alvaro [ES] Latorre Lozano Alfonso [ES]	Fundación IMDEA Nanociencia [ES] Fundacion IMDEA Nanociencia [ES]	
8	Covalently modified graphene	WO2016124803 (A1)	2016-08-11	Calleja Mitjá Fabián [ES] Leret García Sofía [ES] Navarro Ocaña Juan Jesús [ES] Stradi Daniele [DK] Black Morocoima Andrés [ES] Bernardo Gavito Ramón [ES] Garnica Alonso Manuela [ES] Granados Ruiz Daniel [ES] López Vázquez De Parga Amadeo [ES] Pérez Álvarez Emilio [ES] Miranda Soriano Rodolfo [ES]	Fundación IMDEA Nanociencia [ES] Univ Autónoma de Madrid [ES]	
9	Functionalised magnetic nanoparticle	WO2016150521 (A1)	2016-09-29	López Cortajarena Aitziber [ES] Somoza Calatrava Álvaro [ES] Couleaud Pierre [ES] Ocampo García Sandra [ES] Aires Trapote Antonio [ES] Latorre Lozano Alfonso [ES]	Fundación IMDEA Nanociencia [ES]	
10	Functionalized metal nanoparticles and uses thereof for detecting nucleic acids	EP3099814 (A1)	2016-12-07	Somoza Calatrava Álvaro [ES] Latorre Lozano Alfonso [ES] Ortiz Urda Susana [US] Posch Christian [US]	Fundación IMDEA Nanociencia [ES] The Regents of the Univ of California [US]	

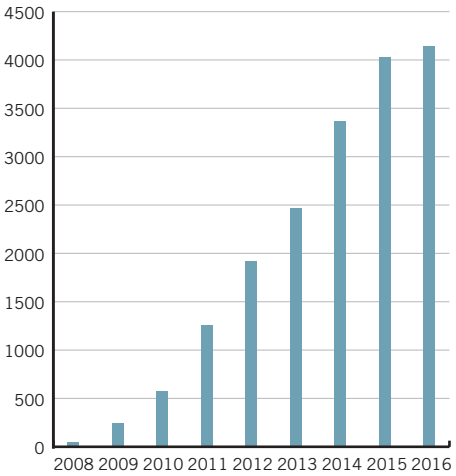
	International classification	Cooperative Patent Classification	Application number	Date of application	Priority number(s)	International search citation
	H01L51/42	H01L51/424, H01L27/305 Y02E10/549, Y02P70/521 H01L51/44, H01L51/424	ES20100031818	20101210	ES20100031818 20101210	
	H01L51/42	H01L51/424, H01L27/305 Y02E10/549	EP20110847054	20111207	WO2010ES31818 20101210 WO2011ES70841 20111207	
	C01B31/04 C08K3/24 C09D5/24 C09D7/12 C09D11/00	C01B31/0438, C01B31/0476 C01B31/0484, C09D5/24 C09D7/1216, C09D11/037 C09D11/324, C08K3/24 C01B2204/04, C01B2204/28 C01B2204/32	WO2014EP66316	20140729	EP20130382311 20130730	WO2013036272 (A1) US7097788 (B2) WO2012051597 (A2) WO2011162727 (A1)
	C08G73/02 G03G5/05	C08G12/08, C08G73/02 C08G73/0273, G03G5/0575 G03G5/14769	WO2014ES70621	20140730	EP20130382313 20130731	US2010224867 (A1) WO2012039683 (A1)
	H01G9/042 B82Y30/00 B82Y40/00	C01B31/0446, B82Y40/00 H01G11/32, H01G11/34 H01G11/86, Y02E60/13 B82Y30/00	ES20130001099	20131122	ES20130001099 20131122	
	C12Q1/68	A61K47/48861, A61K33/24 C12Q1/6816, B82Y5/00 C12Q1/68, C12Q1/6816 C12Q2525/301, C12Q2563/137 C12Q2565/1015	WO2015US12779	20150123	US201461933881P 20140131	US2009137418 (A1) US2013102653 (A1) US2004072157 (A1) US6221397 (B1) US2011223195 (A1) US2010201381 (A1)
	C07D339/04	C07D339/04, C07H21/04	US201414888276	20140429	EP20130382161 20130430 WO2014EP58671 20140429	
	C01B31/04 H01L21/20 H01L31/028	C01B31/04, H01L21/20 H01L31/028	WO2016ES70059	20160202	ES20150030126 20150202	WO2008097343 (A2)
	A61K47/48 A61P35/00	A61K47/48861	WO2015EP56631	20150326	WO2015EP56631 20150326	US2011165086 (A1) WO2008073856 (A2) KR20100070171 (A) CN102631687 (A) WO2006113668 (A1) WO02094325 (A2)
	C12Q1/68	C12Q1/6834, C12Q1/6834 C12Q2525/125, C12Q2525/301	EP20150702742	20150202	EP20140382033 20140131 WO2015EP52034 20150202	WO2007059514 (A2) WO0218951 (A2) US2010201381 (A1) WO2014149071 (A1)

impact of the publications

Publications in each year



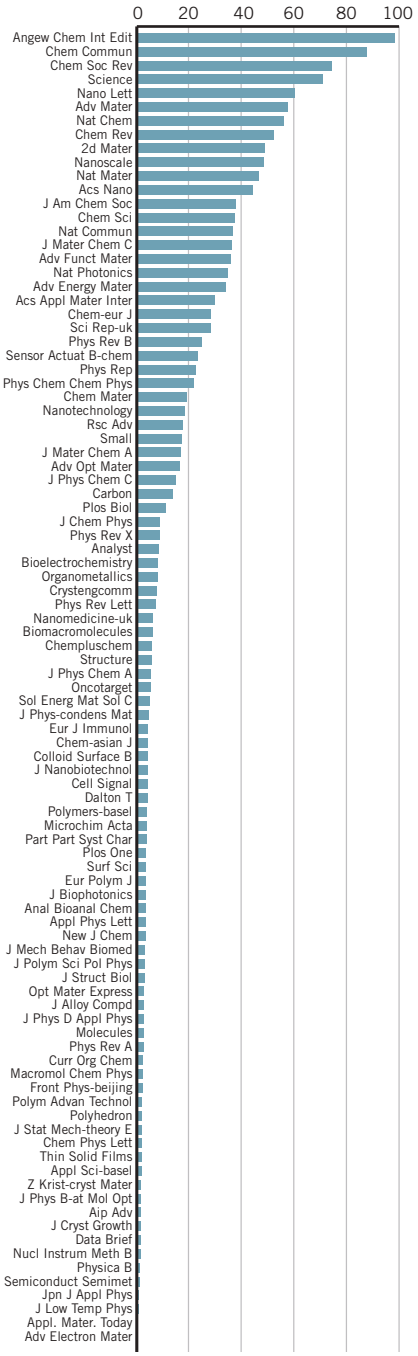
Citations in each year



- **Sum of the times cited:** 18.838
- **Average citation per item:** 16,48
- **h index:** 65

Impact factor of the publications in 2016

Total indexed publications: 209
Average impact factor: 7,054



3.2. International Congresses: Invited Lectures and Regular Contributions

3.2.1. Invited lectures

29.01.2016

Symposium Nanoformas de Carbono: Grafenos y Otros Materiales 2D, ICMol, Valencia, Spain

Phthalocyanine and subphthalocyanine containing carbon nanoestructures"
T. Torres

07-12.02.2016

Gordon Research Conference on Photoionization and Photodetachment, Lucca, Italy

Discussion leader: Matter in intense fields
F. Martín

11-13.02.2016

Symposium on p-Conjugated compounds CpC7, Bordeaux, France

Mixed-Stacked Charge-Transfer Co-Crystals: Tunable Bright Emitters with Ambipolar Charge Transport Characteristics
J. Gierschner

13-20.02.2016

International Winter School on Electronic Properties of Novel Materials, Kirschberg, Austria

New Organic Compounds for Photovoltaic Devices
N. Martín

16-19.02.2016

Nanoportugal 2016, Braga, Portugal

Tailoring graphene for spintronics
R. Miranda

2D Semiconductors for Optoelectronics Applications
A. Castellanos-Gomez

22-26.02.2016

New trends in 2D materials Workshop, Madrid, Spain

Adding magnetic functionalities to epitaxial graphene by self-assembly on or below its surface
F. Calleja

14-16.03.2016

III Biennial Meeting of the Chemical Biology Group, Madrid, Spain

Engineering Protein Scaffolds for Hybrid Functional Materials and Sensors
A. L. Cortajarena

16.03.2016

251st American Chemical Society Meeting, Symposium: Supramolecular Chemistry: A Crown and Anchor Approach, San Diego, California, USA

Supramolecular Properties of Subphthalocyanines
T. Torres

international congresses

15-18.03.2016
Nanospain 2016, Logroño, Spain

Conductive Coordination Polymers at the nanoscale
F. Zamora

30-31.03.2016
67th Mosbacher Kolloquium Protein Design, Mosbach, Germany

Design Protein Scaffolds for Hybrid Functional Materials and Sensors
A. L. Cortajarena

04-08.04.2016
First XLIC WG1 Expert Meeting on "Frontiers in Attosecond Theory: from Atoms to Molecules to Solids, Han-sur-Lesse, Belgium

Pump-probe schemes for attosecond molecular dynamics
F. Martín

11-13.04.2016
EPoLM-2: 2nd Meeting on the Energetic EPoLM-2: 2nd Meeting on the Energetic Processing of Large Molecules, Stockholm, Sweden

Key factors governing the relative stability of charged fullerene isomers
M. Alcami

11-16.04.2016
20th International Conference on Solid Compounds of Transition Elements (SCTE2016), Zaragoza, Spain

Conductive Coordination Polymers at the nanoscale
F. Zamora

13-14.04.2016
FLAG-ERA JTC2015 project Kick-off Meeting, Budapest

Tailoring spin-orbit effects in graphene for spin-orbitronic applications
R. Miranda

02-06.05.2016
European Materials Research Society (EMRS) Spring Meeting 2016, Lille, France

Rare earth-free magnetic powders for permanent magnet applications: from synthesis to technological devices and recycling
A. Bollero

RADIOMAG – A networking project on the combination of magnetic fluid hyperthermia and radiotherapy for cancer treatment
D. Ortega

04-07.05.2016
Energy, Materials and Nanotechnology (EMN), Dubrovnik, Croatia

Lanthanide-directed nanoarchitectures on surfaces
D. Écija

Nanostructured Rare Earth-Free Permanent Magnets for Nowadays and New Technological Applications
A. Bollero

08-11.05.2016
6th Bionanomaterials Conference, Varna, Bulgaria

Nanoparticles biocompatible coating and functionalization for tumor targeting
A. L. Cortajarena

18-19.05.2016
Second DFG meeting on "Quantum Dynamics in Tailored Intense Fields. Dornburg, Germany

Attosecond molecular dynamics: from simple diatomics to biomolecules
F. Martín

17-21.05.2016
European Workshop on Epitaxial Graphene and 2D Materials, Colonia, Germany

Molecules on Graphene
Amadeo L. Vázquez de Parga

19-23.05.2016

EMN Meeting on 2D Materials, San Sebastian, Spain

Spatial variation of a giant spin–orbit effect induces Landau-like levels in graphene
F. Calleja

24-25.05.2016

Meeting of the Graphene Spintronics Flagship, Barcelona, Spain

SO graphene in a nutshell
R. Miranda

28.05-03.06.2016

231st Electrochemical Society Meeting, New Orleans, USA

New strategies for the interfacing of nanomaterials and molecules
E.M. Pérez

29.05.2016-02.06.2016

229th Electrochemical Society (ECS) Meeting, San Diego, California, USA

Bi-thermoelectricity in fullerene-based molecular junctions
N. Agraït

Sugar/Nanocarbon Hybrids As Multivalent Inhibitors of Artificial Ebola Virus Infection

Fullerenes for Catalysis: C60 As Molecular Vector in Hydrogen Transfer Reactions

Chirality Transfer from Graphene Quantum Dots
N. Martín

Tailoring graphene for spintronics
R. Miranda

Rotaxanes Meet Carbon Nanotubes. Synthesis and Physical Properties of Mechanically Interlocked Derivatives of Carbon Nanotubes
E.M. Pérez

Supramolecular-Driven Formation of an Elusive Phthalocyanine-C60 Fullerene Bisadduct Triad

Self-Assembled Molecular Materials Based on Subphthalocyanines
T. Torres

02-03.06.2016

4th International Workshop on 2D Materials, Tordesillas, Spain

Isolation of Highly Stable Antimonene under Ambient Conditions
F. Zamora

05-06.06.2016

CIMTEC 2016, Perugia, Italy

Quantum Confinement in Black Phosphorus through Strain-engineered Rippling
A. Castellanos-Gomez

06-09.06.2016

Conference on Flexible Electronics, Nanjing, China

Realizing low-threshold yellow-green polymer lasing in energy transfer blends: an ultrafast dynamics study of novel hosts for F8BT
J. Cabanillas-Gonzalez

15.06.2016

The singlet oxygen strategy" International Conference, Monasterium Poort Ackere, Ghent, Belgium

Regio-, Stereo-, and Atropselective synthesis of C60 fullerene bisadducts by supramolecular-directed functionalisation"
T. Torres

17.06.2016

Conference ESP-2016 (Excited State Processes in Electronic and Bio Nanomaterials), Santa Fe, New Mexico, USA

Photophysics of Luminescent Single Crystals for Organic Optoelectronics
J. Gierschner

19-24.06.2016

Gordon Research Conference on Multiphoton ProcessesAndover, New Hampsire, USA

Imaging attosecond molecular dynamics with pump-probe schemes: a theoretical perspective
F. Martín

17.06.2016

Congress: Iberian Biophysics Congress, Porto, Portugal

Novel correlative microscopy tools to study Biology at the nanoscale
C. Flors

20-24.06.2016

XI Congreso de Ciencia y Tecnología ESPE 2016, Sangolquí, Ecuador

Molecular electronics
N. Agraït

21-24.06.2016

POLYMAT Spotlights: Approaches to Aromatic 2D and Porous Polymers. San Sebastian, Spain

Spotlights: Approaches to Aromatic 2D and Porous Polymers
N. Martín (plenary)

22-26.06.2016

Icaro International Workshop, Sestri Levante, Italy

Advanced characterization of magnetic heating losses of magnetic nanoparticles
F.J. Terán

24.06.2016

Visiting Professorship Conferring Ceremony / IAM Sparkling Lecture, Nanjing Tech University, Nanjing, China

Photophysics of conjugated polymer blends for optical gain applications
J. Cabanillas-Gonzalez

26.06.2016-03.07.2016

Workshop on Spin Orbit Coupling and Topology in Low Dimensions, Spetses, Greece

Spin Orbit coupling in graphene
R. Miranda

Adding a giant spin-orbit coupling to epitaxial graphene by Pb intercalation
F. Calleja

27.06.2016

International Symposium: "A journey through carbon nanostructures" Toledo, Spain

Tailoring epitaxial graphene for spintronic applications"
R. Miranda

03-07.07.2016

12th International Workshop on Magnetism and Superconductivity at the nanoscale, Coma-ruga, Spain

Characteristic physical lengths and their roles in the competition between magnetism and superconductivity at the nanoscale
J.L.Vicent

03-08.07.2016

9th International Conference in Porphyrins and Phthalocyanines Nanjing, China
Award Lecture: Linstead Career Award in Phthalocyanine Chemistry

Phthalocyanines: old dyes, new molecular materials
T. Torres

Phthalocyanine-based multifunctional ensembles
G. Bottari

05-08.07.2016

Flatlands beyond Graphene 2016 Bled, Slovenia

Novel narrow gap 2D semiconductors for optoelectronics and strain engineering
A. Castellanos-Gomez

06.07.2016

International Workshop on Nanomedicine Madrid, Spain

Advances in the use of nanoparticles in medicine
R. Miranda

09.07.2016

1st Nanjing/Dijon Symposium on Functional Macrocyclic Molecules, Nanjing, China

Subphthalocyanines: Supramolecular Organization and Self-Assembling Properties
T. Torres

14.07.2016

11th International Symposium on Macrocyclic and Supramolecular Chemistry (ISMSC), Seoul, Korea

Subphthalocyanines: Supramolecular Organization and Self-Assembling Properties
T. Torres

17-20.07.2016

XXXVII Reunión de Grupo de Electroquímica de la RSEQ, Alicante, Spain

Advantages of Using Nanomaterials and Metal Complexes in (Bio) sensing Platforms
E. Lorenzo

18.07.2016

International Summer Course on Nanotechnology, Tenerife, Spain

Graphene: From Physics to technology
R. Miranda

20.07.2016

International Summer Course on Nanocarbons El Escorial, Spain

From fullerenes to graphene
R. Miranda

20-22.07.2016

First "Julio Palacios" International Symposium. La Coruña, Spain

Attosecond light: The superslow-motion camera of physics, chemistry and biology
F. Martín

01.08.2016

5th Workshop on Nanocarbon Photonics and Optoelectronics (NPO2016), Imatra, Finland

Dynamics of long-lived photoexcitations in SWNT-polymer blends
L. Lüer

04-07.08.2016

Symposium of functional materials, Zhengzhou, China

Magneto-plasmonics of Au/Co/Au nanoring based structures by Hole mask colloidal lithography
F. Luo

17-18.08.2016

Carbonhagen, Copenhagen, Danemark

Recent advances in graphene research
F. Guinea

21-26.08.2016

Joint European Magnetic Symposia JEMS 2016 Glasgow, UK

Magnetic hyperthermia for treatment of localized tumors
D. Ortega

22-25.08.2016

Global Biotechnology Congress 2016, Boston, Massachusetts, USA

Protein engineering for functional nanostructures and biomaterials
A. L. Cortajarena

28.08-01.09.2016

SPIE Nanoscience + Engineering "Spintronics" Session 1OA Spin-Orbit Coupling, San Diego, California, USA

Chiral asymmetry driven by unidirectional magnetic anisotropy in Spin-Orbitronic systems
P. Perna

31.08-02.09.2016

Ultrafast Imaging of Photochemical Dynamics: Faraday Discussion. Edinburgh, UK.

Decoherence, control and attosecond probing of xuv-induced charge migration in biomolecules. A theoretical outlook.
F. Martín

04-09.09.2016

26th Conference of the Condensed Matter Division of the EPS, Groningen, Netherlands

Recent advances in graphene research
F. Guinea

05-09.09.2016

12th European Conference on Atoms Molecules and Photons (ECAMP12). Frankfurt, Germany

Plenary talk: Attosecond molecular dynamics
F. Martín

08-11.09.2016

IEEE EUROCON 2015 Salamanca, Spain

Towards Spintronics Materials for Energy Saving: Advances in nanomagnetism via x-ray techniques
J. Camarero

11-15.09.2016

6 EuCheMS Chemistry Congress, Sevilla, Spain

Current Challenges in Fullerenes Chemistry. "Honoring to Harry Kroto
N. Martín (congress plenary)

Giant multivalent glycofullerenes as potent inhibitors of Ebola virus infection
N. Martín (plenary)

11-16.09.2016

XXI European Conference on the Dynamics of Molecular Systems (MOLEC 2016). Toledo, Spain

Imaging attosecond molecular dynamics with pump-probe schemes: a theoretical perspective
F. Martín

15.09.2016

46th European Solid-State Device Research Conference (ESSDERC) 2016, Lausanne, Switzerland

Mechanical properties of 2D materials
A. Castellanos-Gomez

15.09.2016

Workshop on Quantum Materials, Braga, Portugal

2D materials for quantum technologies
A. Castellanos-Gomez

15.09.2016

COST Action Topical Meeting on Nanoparticles, Warsaw, Poland

Organic Semiconductor Nanoparticles for Optoelectronic and Bio Applications: Preparation, Structure & Photophysics
J. Gierschner

20-21.09.2016

10th RES Users' Conference, León, Spain

Attosecond xuv-induced charge migration in biomolecules
F. Martín

30.09.2016

Interdisciplinary Center for Molecular Materials (ICMM) Friedrich AlexanderUniversitaet Erlangen Nuernberg, Erlangen, Germany

Phthalocyanines: old dyes, new molecular materials
T. Torres

13-14.10.2016

III Reunión de Jóvenes Investigadores en Coloides e Interfases, Madrid, Spain

Nanotribology, Surface Interactions and Characterization: Unconventional Applications of AFM
R.Alvarez-Asencio

24-28.10.2016

Workshop On Correlations, Integrability, And Criticality In Quantum Systems Évora, Portugal

Novel quantum effects in graphene and two dimensional dichalcogenides
F. Guinea

26-28.10.2016

VII Encuentro de Física y Química de Superficies 2016, Santa Fe, Argentina

Advanced magneto-optic based instrumentation: From vectorial-resolved MOKE to element-resolved magnetic holography imaging
J. Camarero

Role of magnetic anisotropy in magnetic nanostructures: from spintronic to biomedical applications
J. Camarero

02-04.11.2016

Carbon Nanotubes meets 2D Materials, Heidelberg, Germany

Electromechanical properties of 2D materials and related devives
A. Castellanos-Gomez

04-05.11.2016

International Conference on Advances in Nanomaterials and Nanotechnology (ICANN-2016), 4-5 November 2016, New Delhi, India

The mechanical bond and carbon nanotubes, first steps in a promising relationship and Covalent Patterning of Graphene with Atomic Selectivity
E.M. Pérez

04-09.11.2016

CMD26 - Condensed Matter in Groningen, Groningen, the Netherlands

Electron scattering and quantum confinement in organic nanostructures on metal surfaces.
R. Otero

07-09.11.2016

Trends in Organic Photophysics, Milano, Italy

Photophysics of conjugated polymer blends for optical gain applications
J. Cabanillas-Gonzalez

07-11.11.2016

International Conference on Technologically Advanced Materials and Asian Meeting on Ferroelectricity (ICTAM-AMF10), New Delhi, India

Mixed dimensional heterostructures beyond van der Waals
E.M. Pérez

12-17.11.2016

Recent Progress in Spintronics of 2D Materials, Taipei, Taiwan

Could a spatial variation of the S-O coupling induce the discretization of graphene's density of states?
F. Calleja

21-23.11.2016

International workshop on the Dynamics of Complex Molecular Systems, Caen, France

New strategies to model fragmentation of charged biomolecules
M. Alcamí

The unusual stability of charged, endohedral and exohedral fullerenes
F. Martín

23.11.2016

2D Materials: from physics to engineering, Grenoble, France

Electromechanical properties of 2D materials and related devives
A. Castellanos-Gomez

24.11.2016

International Congress: Next Generation Solar Energy Meets Nanotechnology, Erlangen, Germany

Detecting loss channels in organic photovoltaic devices
L. Lüer

30.11-01.12.2016

New Frontiers and Advanced Applications of 4th generation light sources to Atomic, Molecular, Optical, and Cluster ScienceTrieste, Italy

Pump-probe schemes for attosecond molecular dynamics.
F. Martín

01-02.12.2016

Japan-Spain Workshop on Nanomedicine Researc AMED_MINECO_ ISCIII, Madrid, Spain

Nanomedicine at IMDEA Nano
R. Miranda

06.12.2016

9th Asian & Oceanian Photochemistry Conference, Singapore

Hybrid Nanoscopy of Hybrid Nanomaterials
C. Flors

12-15.12.2016

Advanced Microscopy and Spectroscopy of Supramolecular and Macromolecular Systems on Surfaces. Hong Kong, China

Lanthanides at surfaces
D. Écija

Quasiparticle Interference Spectroscopy of Molecular Systems
Roberto Otero

18-20.12.2016

QuEEN European Workshop, Oxford, UK

Can we use molecular junctions for energy harvesting?
N. Agraït

3.2.2. Regular contributions

International Congresses

07-11.01.2016

MMM - Intermag 2016, San Diego, California, USA

Oral Contributions

Direct observation of temperature-driven magnetic symmetry transitions by v-MOKE magnetometry
J. L. F. Cuñado; J. Pedrosa; F. Ajejas; A. Bollero; Paolo Perna; R. Miranda; J. Camarero

Direct views on the origin of anisotropic magnetoresistance in thin films and multilayered structures
Paolo Perna; Davide Maccariello; José Luis F. Cuñado; Alberto Bollero; Fernando Ajejas; Javier Pedrosa; Miguel Angel Niño; Manuel Muñoz; JL Prieto; Rodolfo Miranda; Julio Camarero

Tuning unprecedented exchange-bias effects in orthogonally-coupled ferromagnetic bilayers
F.J. Pedrosa, J.L.F. Cuñado, J. Camarero, M. Seifer, V. Neu, V. Baltz, D. Serantes, O. Chubykalo-Fesenko, R.P. del Real, M. Vázquez, L. Schultz, B. Dieny, R. Miranda, and A. Bollero

Interfacial coupling induced symmetry-breaking of spinorbit interaction in exchange biased systems
Paolo Perna; Davide Maccariello; Fernando Ajejas; Ruben Guerrero; Miguel Angel Niño; Julio Camarero; Rodolfo Miranda

Magnetoresistance and proximity effects in asymmetric multilayers with PMA
D. Maccariello; N. Reyren; C. Moreau- Luchaire; K. Garcia; P. Perna; J. Camarero; V. Cros; A. Fert

Tunning Dzyaloshinskii-Moriya exchange interaction in asymmetric PMA structures
Alberto Bollero; T. Pérez-Castañeda; JLF Cuñado; Paolo Perna; A. Maldonado; Fernando Ajejas; Javier Pedrosa; Miguel Angel Niño; Ruben Guerrero; D. Cabrera; Francisco Terán; Rodolfo Miranda; Julio Camarero

27-28.01.2016

8th European Symposium on Computing ϖ-Conjugated Compounds, Málaga, Spain

Oral Contribution

Mechanical and Electronic Properties of Mechanically Interlocked Carbon Nanotubes (MINTs)

Belén Nieto-Ortega, Alejandro López-Moreno, Alberto de Juan, Maria Moffa, M. Mar Bernal, Juan P. Fernandez-Blázquez, Juan J. Vilatela, Dario Pisignano, Emilio M. Pérez.

22. 26.02.2016

New Trends in 2D Materials Workshop, IMDEA Nanociencia, Madrid, Spain

Oral Contribution

Signatures of topological superconductivity in the Meissner states

L. Chirolli, F. Guinea

Poster Contribution

Spin relaxation induced by spin-lattice coupling

M. Vicent, H. Ochoa, F. Guinea

14-16.03.2016

III Biennial Meeting of the Chemical Biology Group, Madrid, Spain

Oral Contribution

Antibacterial Activity of Silver Nanoclusters Tuned by Oligonucleotides

Alfonso Latorre, Siamak Javani, Romina Lorca, Cristina Flors, Aitziber L. Cortajarena, Álvaro Somoza.

Poster Contribution

BSA-AuNCs Based Nanopartcles For Combined Chemotherapy

Ana Latorre, Alfonso Latorre, Macarena Calero, Ana Lázaro, Ángeles Villanueva, Álvaro Somoza

29-31.03.2016

FNIA – Functional Nanomaterials in industrial applications: Academic-Industry Meet. University of Central Lancashire, Preston, UK

Oral Contribution

Surface plasmons in surface in synergy with the spin crossover phenomena at the nanometric scale

Jose Sánchez Costa

02-06.05.2016

European Materials Research Society (EMRS) Spring Meeting 2016, Lille, France

Oral Contribution

Thin Film as Model Systems for Permanent Magnets without Critical Raw Materials

E. Céspedes, G. Rodríguez-Rodríguez, C. Navío, R. Guerrero, M. Rodríguez, F. J. Pedrosa, F. J. Mompean, M. García-Hernández, A. Quesada, J. Camarero, A. Bollero

Poster Contributions

Assessment of the iron oxide nanoparticle coating features required for in vivo studies

Antonio Aires, David Cabrera, Laura C. Alonso-Pardo, Aitziber L. Cortajarena and Francisco J. Terán

In Vivo Deep Tissue Fluorescence and Magnetic Imaging Employing Hybrid Nanostructures

D. H. Ortgies, L. de la Cueva, B. del Rosal, F. Sanz-Rodríguez, N. Fernández, M. C. Iglesias-de la Cruz, G. Salas, D. Cabrera, F. J. Terán, D. Jaque, and E. Martín Rodríguez

11-15.05.2016

MMM - Intermag 2016, San Diego, California, USA

Oral Contributions

Direct observation of temperature-driven magnetic symmetry transitions by vectorial-resolved MOKE magnetometry

JL Cuñado; Javier Pedrosa; Fernando Ajejas; Alberto Bollero; Paolo Perna; Rodolfo Miranda; Julio Camarero

Direct views on the origin of anisotropic magnetoresistance in thin films and multilayered structures

Paolo Perna; Davide Maccariello; JL Cuñado; Alberto Bollero; Fernando Ajejas; Javier Pedrosa; Miguel Angel Niño; Manuel Muñoz; JL Prieto; Rodolfo Miranda; Julio Camarero.

Interfacial coupling induced symmetry-breaking of spinorbit interaction in exchange biased systems
Paolo Perna; Davide Maccariello; Fernando Ajejas; Ruben Guerrero; Miguel Angel Niño; Julio Camarero; Rodolfo Miranda

Magnetoresistance and magnetic proximity effects in asymmetric metallic multilayers with perpendicular magnetic anisotropy.
Davide Maccariello; Nikolas Reyren; C. Moreau-Luchaire; K. Garcia; Paolo Perna; Julio Camarero; Vincent Cros; Albert Fert

31.05.2016-04.06.2016

11th International Conference on the Scientific and Clinical Applications of Magnetic Carriers, Vancouver, Canada

Oral Contributions

Harnessing viscosity effects to tailor the dynamical magnetic response of magnetic nanoparticles
D.Cabrera, M. E.Materia, A. Lak, D. Ortega, P. Guardia, A. Sathya, F. Ludwig, T. Pellegrino and F. J. Teran

RADIOMAG – A COST networking project in experimental cancer treatment research, combining magnetic fluid hyperthermia and radiotherapy
S. Spassov, D. Ortega and RADIOMAG team

Real-time tracking of delayed-onset cellular apoptosis induced by intracellular magnetic hyperthermia
C. Blanco-Andújar, D. Ortega, P. Southern, S. A. Nesbitt, N. T. K. Thanh and Q. A. Pankhurst

12-16.06.2016

16th International Conference on Electroanalysis (16th ESEAC), Bath, UK

Oral Contributions

2D and 3D Diamond Nanoparticles-Lactate Oxidase Arrangements for Improved Lactate Biosensors.
E. Lorenzo, M. Briones, M. D. Petit-Dominguez, M. L. Vázquez, F. Pariente and E. Casero.

Aminoacids Related Metabolic Diseases Direct Determination by Chromatography Coupled to a Highly Efficient Nanostructured Electrochemical Detector.
M. Revenga-Parra, E. Martinez-Periñán, F. Zamora, F. Pariente and E. Lorenzo.

Poster Contribution

Disposable nanostructured sensors for rapid biomarkers determination.
F. Pariente, Martinez- Periñán, M. Revenga-Parra, B. Moreno and E. Lorenzo.

12-17.06. 2016

8th International Conference on Technological Advances of Thin Films and Surface Coatings., Singapore

Oral Contribution

A Highly Luminescent Silver-Thiocarboxylate Crystalline and Free-Standing Thin Film
F. Zamora

14-17.06. 2016

BPS2016: Engineering Approaches to Biomolecular Motors: From in vitro to in vivo, Simon Fraser University, Vancouver, Canada

Oral Contribution

Mechanical Tension vs. Force: Different ways to control the activities of molecular motors working on DNA
B. Ibarra

20-22.06.2016

6th Early Stage Researchers Workshop in Nanoscience IMDEA Nanociencia, Madrid, Spain

Oral Contributions

Conductance and thermopower measurements in single-molecule junctions
Laura Rincón-García, Charalambos Evangeli, Edmund Leary, M. Teresa González, Gabino Rubio-Bollinger and Nicolás Agraït

Franckeite: a naturally formed van der Waals heterostructure with a narrow bandgap
Aday J. Molina-Mendoza, Emerson Giovanelli, Wendel S. Paz,Miguel Angel Niño, Joshua O. Island, Charalambos Evangeli, Lucía Aballe, Michael Foerster, Herre S. J. van der Zant, Gabino Rubio-Bollinger,Nicolás Agraït, J. J. Palacios, Emilio M. Pérez,andAndres Castellanos-Gomez.

Research in MnAl: an alternative to rare earth-based permanent magnets
J. Rial, M. Villanueva, F.J. Pedrosa, N. López, J. Camarero, L. G. Marshall, I.
J. McDonald, L. H. Lewisb and A. Bollero

Strong quantum confinement effect in the optical properties of ultrathin α-In2Se3
Jorge Quereda, Robert Biele, Gabino Rubio-Bollinger, Nicolás Agräit, Roberto D'Agosta and Andres Castellanos-Gomez.

Enhanced Magneto-optical Effect in Magnetoplasmonic Ring-Split Ring Structures
Hua Yu Feng,aFeng Luo, Raul Arenal, Fernando García, Gaspar Armelles, and Alfonso Cebollada

Ag2S nanocrystals as Band-Shape Luminescence Nanothermometry (BSLNth) probes
Diego Ruiz, María Acebrón, Chen Sun, Ana B. Hungría, and Beatriz H. Juárez

Conformational competition between G-quadruplex assembly and RNA condensation unveiled at the singlemolecule level
Irene Gutiérrez, Miguel Garavís,Sara de Lorenzo, Alfredo Villasante, Carlos González and J.Ricardo Arias-González

Hybrid nanoscopy for hybrid nanomaterials
Patricia Bondia, Santiago Casado, Rocío Jurado, José M. Domínguez-Vera, Natividad Gálvez and Cristina Flors

Single-molecule mechanical characterization of the HmtSSB binding properties to ssDNA
Fernando Cerron, Jose A. Morin, Javier Jarillo, Laurie S. Kaguni, Grzegorz L. Ciesielki, Francisco J. Cao, and Borja Ibarra

Antibacterial Cicada Inspired Polymer Topography
Felipe Viela, Ivan Navarro and Isabel Rodriguez

Repeat proteins as template to organize gold nanoparticles
Sara H. Mejías,Pierre Couleaud, David Romera, Ana Lasanta, Teresa González, Jose M. Abad, Santiago Casado, Daniel Granados, Manuel Rodrígez and Aitziber L. Cortajarena

Adhesion modification of neural stem cells induced by nanoscale ripple patterns
Patricia Pedraz, Santiago Casado,Vanessa Rodríguez, Maria Caterina Giordano, Francesco Buatier de Mongeout, Ángel Ayuso-Sacido and Enrico Gnecco

The Tumor Microenvironment as a Ru(II) Complexes Target
Francisco Martínez-Peña and Ana M. Pizarro

Hydrogen-bonded nanorings marrying carbon nanofingers
R. Chamorro-Mendiluce, L. De Juan, E. M. Pérez and D. González-Rodríguez

Beneficial effect of the mechanical bond on carbon nanotube polymer fillers. The Reason of Performance Loss in OPV Devices with SWNTs
Abasi Abudulimu,Mirella El Gemayel, Imge Namal,Klaus Eckstein, Tobias Hertel, Andreas Distler and Larry Lüer

Non-Fullerene All-Small-Molecules Organic Solar Cells: Morphology and Photophysics of a New Player in the Market
Junqing Shi, Marius van der Berg, Oh Kyu Kwon, Larry Lüer, Alfred J. Meixner, Dai Zhang Soo, Young Park, Johannes Gierschner

Hydrogen bonding and _-stacking-induced self-assembly of picolinic acid-substituted phthalocyanine derivatives
Luis M. Mateo, Giovanni Bottari, Beatriz Ballesteros, Beatrice Berionni Berna and Tomás Torresa

Facile, Effective, Reproducible and Reversible Photosensitivity of MoS2 with Organic Chromophores
Leire de Juan, Sofía Leret, Aday Molina, Luis Vaquero, Andrés Castellanos,and Emilio M. Pérez

Chirality transfer from graphene quantum dots
Mikiko Vázquez-Nakagawa, Laura Rodríguez-Pérez, Mª Ángeles Herranz and Nazario Martín

Poster Contributions

Tuning antisymmetric dzyaloshinskii-moriya exchange interaction in fm/graphene interfaces
Fernando Ajejas, Paolo Perna, Ruben Guerrero, Julio Camarero and Rodolfo Miranda

Photodetectors based on wedge structured heterojunctions and their application
Guilin Liu, Juan Cabanillas González and Miguel Angel Niño

Molecular Swimmer at Low Reynolds Number
Sofía Mena Hernando and Emilio M.Pérez

Tailoring of the optoelectronic properties of few layer Molybdenum Disulfide (MoS2) Devices via Pulsed eBeam Gas Assisted Patterning
F.J. Urbanos, Andrés Black, Ramón Bernardo-Gavito, Manuel R. Osorio, Rodolfo Miranda, Daniel Granados

Brightening, bleaching and blueing dynamics of QDs in an optical trap
Héctor Rodríguez Rodríguez,María Acebrón, Beatriz H. Juarez and J. Ricardo Arias-González

Effect of Backbone Encapsulation on the Photophysics of Conjugated Self- Threading Polythiophene
Chen Sun, Larry Lüer, Nazario Martín and Juan Cabanillas-Gonzalez

Microemulsion-assisted SILAR method for inorganically coated colloidal quantum dots
María Acebrón, Ramón Bernardo,b Daniel Granados and Beatriz H. Juárez

Highly Luminescent Host-Guest Supramolecular Polymers: Structural Insight by PL Spectroscopy & Microscopy
Nandajan P. C., Hyeong-Ju Kim, Reinhold Wannemacher, Soo Young Park andJohannes Gierschner

Easily attainable new hole transporting materials for high performance perovskite solar cells
Javier Urieta Mora, Agustín Molina-Ontoria and Nazario Martín

Mechanical Interlocking vs Polymer Wrapping of SWNTs
Sofía Leret García and Emilio M. Pérez

Mechanically Interlocked Single Wall Carbon Nanotube (MINTs) based on electron acceptor macrocycles
Alberto de Juan, Emiliano Martínez-Periñán, Encarnación Lorenzo and Emilio M. Pérez

Toxicity of SPION in the environment
Jara Hurtado-Gallego, G. Pulido-Reyes, Gorka Salas, Roberto Rosal, F. Leganés, Francisca Fernández-Piñas

BSA-Stabilized Gold Nanoclusters as Drug Delivery System
Juan Martínez, Alfonso Latorre, Álvaro Somoza

Functionalized gold nanoparticles for the detection of uveal melanoma miRNAs
Catarina Coutinho, Christian Duarte, Alfonso Latorre, Álvaro Somoza

Pulling hydrogen bonds apart. Measurement of noncovalent interactions with optical tweezers
Teresa Naranjo, Belén Nieto, Fernando Cerrón, Álvaro Somoza, Borja Ibarra and Emilio M. Pérez

26-30.06. 2016

Solitons and Skyrmion Magnetism (Sol-SkyMag 2016), San Sebastian, Gipuzkoa, Spain

Oral Contributions

Tuning Dzyaloshinskii-Moriya exchange interaction in asymmetric PMA (perpendicular magnetic anisotropy) structures
Fernando Ajejas, Ruben Guerrero, Rodolfo Miranda, Julio Camarero And Paolo Perna

Interfacial Coupling Induced Symmetry-Breaking of Spin-Orbit Interaction In Exchange Biased Systems
Fernando Ajejas, Paolo Perna, Davide Maccariello, Ruben Guerrero, Rodolfo Miranda And Julio Camarero

Emergence of the Stoner-Wolfhart Astroid in Thin Films at Dynamic Regime
A. Bollero, T. Pérez-Castañeda, J. L. F. Cuñado, P. Perna, A. Maldonado, F. Ajejas, F. J. Pedrosa, M. A. Niño, R. Guerrero, R. Miranda, And J. Camarero

28.06-02.07.2016

International Conference of Synthetic Metals, Guanghzhou, China

Oral Contribution

Ground state host-guest interactions upon effective dispersion of regioregular Poly(3-hexylthiophene) in Poly(9,9-dioctylfluorene-alt-benzothiadiazole
J. Cabanillas-Gonzalez

Poster Contribution

Low Threshold Amplified Spontaneous Emission and Lasing from Flexible All-Polymer Nanostructures
J. R. Castro Smirnov, Qi Zhang, Longfei Wu, Ruidong Xia, Isabel Rodríguez and Juan Cabanillas González

10-14.07.2016

11th International Symposium on Macrocycle and Supramolecular Chemistry (ISMSC 2016), Seoul, Korea

Poster Contribution

Unprecedented regio-, stereo- and atropselective synthesis of non-tethered cis-1 C60 fullerene bisadducts by supramolecular-directed functionalization
G. Bottari, O. Trukhina, T. Torres

10-15.07.2016

XXIII International Summer School 'Nicolás Cabrera', Madrid, Spain

Poster Contribution

Single-molecule mechanical characterization of HmtSSB binding to ssDNA
Fernando Cerrón, Jose A. Morín, Javier Jarillo, Laurie S. Kaguni, Grzegorz L. Cieselki, Francisco J. Cao, Borja Ibarra.

18-22.07.2016

XXII International Round Table on Nucleosides, Nucleotides and Nucleic Acids, Paris, France

Poster Contribution

Functionalized Nanostructures for Biomedical Applications

Alfonso Latorre, Ana Latorre, Catarina Coutinho, Christian Duarte, Álvaro Somoza

08-11.08.2016

The 37th Progress in Electromagnetics Research Symposium, Shanghai

Oral Contribution

Magnetoplasmonics in Split Ring-ring Structures Fabricated with Hole-mask Colloidal Lithography

Feng, H. Y., Luo, F., Arenal, R., Henrard, L., García, F., Armelles, G., & Cebollada, A

21-25.08.2016

252nd American Chemical Society National Meetining, Philadelphia, PA, USA

Oral Contributions

Beneficial effect of the mechanical bond on carbon nanotube polymer fillers

A. López, M. Molfa, M. Bernal, A. de Juan, J. Fernandez-Blázquez, J.J. Vilatela, D. Pisignano, E.M. Pérez

Mechanically interlocked single wall carbón nanotube (MINTS) based on electron acceptor macrocycles

E. Martinez Periñan, E. Lorenzo, E.M.Pérez

Pulling hydrogen bonds apart. Measurement on noncovalent interactions with optical tweezers

T. Naranjo, B. Nieto, A. Somoza, B. Ibarra, E.M. Pérez

21-25.08.2016

Topological States of Matter School, Donostia-San Sebastián, Spain

Poster Contribution

Signatures of topological superconductivity in the Meissner states

Chirolli, F. Guinea

21-26.08.2016

Joint European Magnetic Symposia JEMS 2016, Glasgow, UK

Oral Contribution

Interfacial Coupling Induced Symmetry-Breaking of Spin-Orbit Interaction In Exchange Biased Systems

Fernando Ajejas, Paolo Perna, Davide Maccariello, Ruben Guerrero, Rodolfo Miranda And Julio Camarero

Poster Contributions

Thickness and Angular dependent Magnetic anisotropy studies of bi-axially strained La0.67Sr0.33MnO3 thin films by Magneto-Optical Kerr spectroscopy

Sandeep Kumar Chaluvadi, Paolo Perna, Fernando Ajejas, Julio Camarero, Alain Pautrat4, Stéphane Flament and Laurence Méchin

Angular-dependent magnetic properties of interfacial exchange-coupled ferromagnetic and multiferroic BiFeO3 thin films

Julio Camarero, Paolo Perna, Fernando Ajeja,, José Luis F. Cuñado, Sergio L. de las Heras, Cecilia Rodrigo, Rodolfo Miranda, Jullie Albille, Cyrille Deranlot, Agnès Barthélémy, Manuel Bibes

22-26.08.2016

8th international conference on Molecular electronics (ElecMol), Paris, France

Oral Contributions

The Mechanical Bond and Carbon Nanotubes, First Steps in a Promising Relationship.

Emilio M. Perez

All you need is TTF? A Multi-Purpose Molecular Wire

Edmund Leary, M. Teresa González, Raúl García, M. Ángeles Herranz, Gabino Rubio Bollinger, Marius Bürkle, Linda A. Zotti, Yoshihiro Asai, Fabian Pauly, Juan Carlos Cuevas, Nicolás Agraït, Nazario Martín, Christian R. Parker, Karsten S. Jennum, Emil Glibstrup, Mogens Brøndsted Nielsen, Nicola J. Kay,Jan Oskar Jeppesen, Jess Lycoops, Jens Ulstrup, Simon Higgins and Richard J. Nichols

Poster Contribution

Discovering new materials through computational methods

Lucas Viani, Benedetta Mennucci, Soo Young Park, Johannes Gierschner

28.08.2016-01.09.2016

13th European Inorganic Chemistry Conference, Budapest, Hungary

Poster Contribution

pH-dependent ruthenium metallodrugs

Francisco Martínez-Peña; Ana M. Pizarro

29.08.2016-01.09.2016

SPIE 2016 Optics + Photonics, San Diego, California, USA

Oral Contribution

Optical trapping and luminescence of silica encapsulated quantum dots

H. Rodriguez-Rodriguez, M. Acebron, J. R. Arias-Gonzalez and B. H. Juárez

29.08.2016-01.09.2016

SPIE 2016 Nanoscience+ Engineering, San Diego, California, USA

Oral Contributions

Optical trapping and luminescence of silica encapsulated quantum dots

HR Rodríguez, M Acebrón, JRA González, BH Juárez

05-07.09.2016

Fuerzas y Túnel 2016, Girona, Spain

Oral Contribution

Lanthanide-carboxylate nanomeshes with tunable cavity size and coordination node

B. Cirera, R. Otero, J. M. Gallego, R. Miranda, and D. Écija

05-09.09.2016

Topological States of the Mstter Workshop, Donostia-San Sebastian, Spain

Poster Contribution

Signature of Topological Superconductivity in the Meissner state

R. Zhang,L. Chirolli, F. de Juan,F. Guinea, I. V. Grigorieva, and A. K. Geim

11-15.09.2016

6 EuCheMS Chemistry Congress, Sevilla, Spain

Oral Contributions

The mechanical bond and carbon nanotubes, first steps in a promising relationship
Emilio M. Perez

Photoinduced corrugation of graphene
Sofia Leret García, Andrés Black, Daniel Granados, Amadeo L. Vázquez de Parga, Emilio Pérez

Poster Contributions

Facile, Effective, Reproducible and Reversible Photosensitivity of MoS2 with Organic Chromophores
Leire de Juan Fernández, Emilio Pérez Álvarez, Andrés Castellanos, Sofía Leret, Aday Molina, Luis Vaquero-Garzón

Nanoribbons based on Cu (N-4,4'-bipyridine) Thymine coordination polymer for selective oligonucleotide molecular recognition
Verónica García-Vegas, Khaled Hassanein, Romina Lorca, Ana Latorre, Álvaro Somoza, Carlos Gómez-García, Óscar Castillo, Félix Zamora, Pilar Amo-Ochoa

19-22.09.2016

E-MRS 2016 Fall Meeting. Symposium B (Bioinspired and biointegrated materials as frontiers nanomaterials VI) (no. B.P. 2.12) Warsaw University of Technology, Warsaw, Poland

Poster Contribution

Broad Spectrum Bactericidal Polymer Topography
Felipe Viela, Ivan Navarro, Jaime Hernandez, Isabel Rodriguez

26-28.09.2016

International Conference on Nanoimprint & Nanoprint Technology, NNT 2016, Braga, Portugal

Poster Contribution

Superhydrophic Nanoimprinted Structures with Enhanced Durability
Jaime J. Hernández, Felipe Viela, Ivan Navarro, Manuel Rodríguez, Miguel Monclús, Jon Molina, Isabel Rodríguez

27-30.09.2016

Annual Meeting of the European Optical Society, Berlin, Germany

Oral Contribution

On the problem of realizing low-threshold yellow-green lasing in energy transfer polymer blends
J. Cabanillas-Gonzalez

Enhanced Amplified Spontaneous Emission and Lasing from Flexible Transparent Full Plastic Devices.
J. R. Castro Smirnov, Qi Zhang, Longfei Wu, Ruidong Xia, Isabel Rodríguez and Juan Cabanillas González

19-21.10.2016

European Conference on Nanofilms (ECNF) 2016, Bilbao, Spain

Oral Contributions

Signatures of topological superconductivity in the Meissner states
L. Chirolli, F. Guinea

Toward adaptive optics with single layer transition metal dichalcogenides
Riccardo Frisenda

30.10-01.11.2016

Labeling & Nanoscopy, Heidelberg, Germany

Oral Contribution

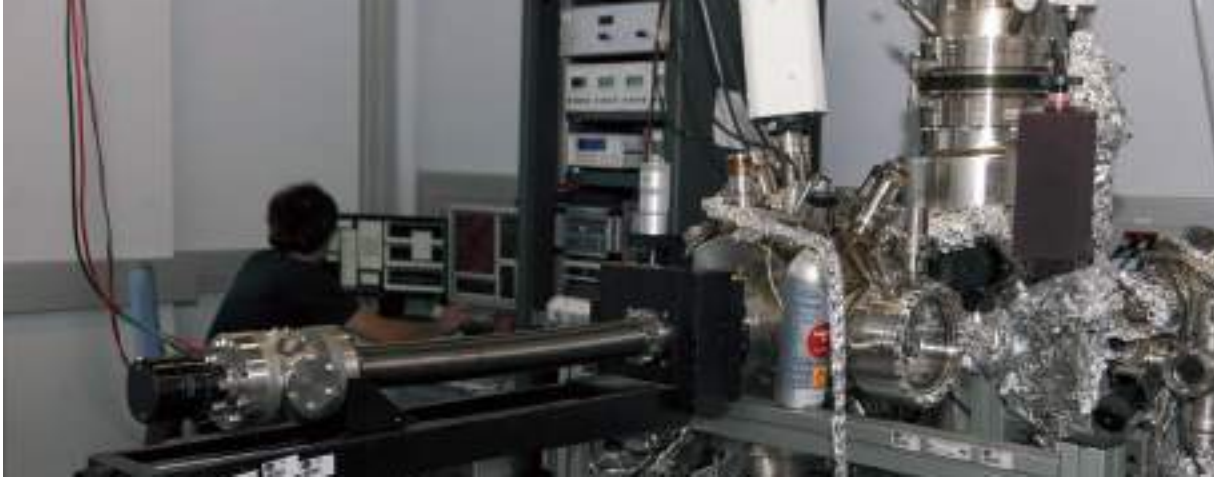
Hybrid Nanoscopy of Hybrid Nanomaterials
P. Bondia, S. Casado, R. Jurado, J. M. Domínguez-Vera, N. Gálvez, C. Flors

30.10-04.11.2016

61st Annual Conference on Magnetism and Magnetic Materials (61st-MMM), New Orleans, Louisiana, USA

Oral Contribution

Spontaneous Room Temperature Exchange Bias Formation in Polycrystalline IrMn Based Spin Valves
A. Migliorini, M. Muñoz, J. Fernandez Cuñado, J. Camarero, C. Aroca,and J.L. Prieto



04-05.11.2016

VI CNIC conference "Mechanical Forces in Physiology and Disease, Madrid, Spain

Poster Contribution

Biomechanical Cell Regulation By High Aspect Ratio Nanoimprinted Pillars
Felipe Viela, Daniel Granados, Angel Ayuso-Sacido, and Isabel Rodríguez

08-09.11. 2016

Workshop on Emerging Trends in Photophysics, Politecnico di Milano, Italy

Oral Contribution

In Silico Excited State Absorption Spectra of Conjugated Polymers
J. Gierschner

08.11.2016

III Jornadas del Instituto de Investigación Sanitaria de las Islas Baleares, Mallorca, Spain

Oral Contribution

Efecto de la chaperonina CCT en la formación de fibras amiloides de Synucleína, la proteína responsable de la enfermedad del Parkinson
B. Sot

22-24.11.2016

NanoBio&Med, Barcelona, Spain

Posters

Hybrid nanoscopy of hybrid nanomaterials
P. Bondia, S. Casado, R. Jurado, J. M. Domínguez-Vera, N. Gálvez, C. Flors,

Photosensitizing flavoproteins: improved biotags for nanoscale imaging with correlative microscopy
A. Rodríguez-Pulido, A. L. Cortajarena, J. Torra, R. Ruiz-González, S. Nonell, C. Flors

30.11.2016-01.12.2016

Discussion Meeting on Progress in Organic Optoelectronics, IMDEA Nanoscience, Madrid

Oral Contribution

Charge-Transfer Co-Polymers & Co-Crystals
J. Gierschner

12-15.12.2016

Advanced Microscopy and Spectroscopy of Supramolecular and Macromolecular Systems on Surfaces. Hong Kong, China

Oral Contribution

Preservation of Electronic Properties of Ln-(OETAP)2 Complexes on Coinage Metals
B. Cirera, R. Otero, J. M. Gallego, R. Miranda, J. V Bath, W. Auwärter, J. R. Galán-Mascarós, and D. Écija

15-16.12.2016

Workshop on physical virology, CIC NanoGUNE-San Sebastian, Spain

Oral Contribution

Structural virotechnology, or how 3D cryo-EM facilitates viral biotechnology
J.R. Castón, C.P. Mata, J. Mertens, D. Luque, J. Bárcena, J.L. Carrascosa.

3.3. Workshops & courses (co)-organized by IMDEA Nanociencia

22-23.02.2016

POCAONTAS Second Annual Meeting – and Photo-Carbon Workshop

22. 26.02.2016

SPINOGRAPH WORKSHOP 2016 - New trends in 2D materials

04.03.2016

SOGRAPHENE (Tailoring Spin-Orbit effects in graphene for spin-orbitronic applications) Kick-off Meeting

10-11.05.2016

NoCanTher Kick-off Meeting

08-10.06.2016

The Protein Multiverse Workshop

22-23.06.2016

6th Early Stage Researchers Workshop in nanoscience

18.10.2016

1st IMDEA Nanociencia Celebrates the Nobel Prize Winners Simposium

30.11.2016

Meeting. "Oportunidades de Colaboración en Investigación e Innovación en Nanotecnología con la Republica Checa"

30.11-01.12.2016

Progress in Organic Optoelectronics

01.12.2016

Japan-Spain Joint Workshop on Nanomedicine Research

3.4. Seminars

Friday, January 22th

Design of a new tool for immunotherapy based on the protein GroEL

Dr. Begoña Sot

IMDEA Nanoscience. Madrid, Spain.

Tuesday, February 9th

Recent Advances in Mesoporous Silica Nanoparticles for Drug Delivery

Dr. Miguel Manzano

Departamento de Química Inorgánica y Bioinorgánica, Facultad de Farmacia Universidad Complutense de Madrid

Friday, February 12th

Facts and Friction, feeling small: Hair interactions, responsive surfaces perception and nanotribology

Profesor Mark Rutland

Professor at KTH Royal Institute of Technology Sweden

Wednesday, March 9th

Molecular-based switchable coordination complexes called Spin Crossover (SCO) as promising materials for technological

Dr. José Sanchéz Costa

IMDEA Nanoscience. Madrid, Spain

Tuesday, March 15th

Inorganic Nanoparticles as platform to combine chemical and biological features with exploitation in medicine

Dr. Teresa Pellegrino

Italian Institute of Technology, Genoa (Italy)

Tuesday, March 29th

Nanofabrication and characterization of superconducting kinetic inductance detectors for space exploration

Dr. Alicia Gómez

Centro de Astrobiología (INTA-CSIC), Ctra. Torrejón-Ajalvir, km. 4. 28850 (Madrid)

Tuesday, April 12th

Overgrowths on Mineral Surfaces

Dr. Carlos M. Pina

Departamento de Cristalografía y Mineralogía. Universidad Complutense de Madrid. Instituto de Geociencias, IGEO (UCM-CSIC). Madrid, Spain. IMDEA Nanoscience. Madrid, Spain

Tuesday, April 19th

Towards an understanding of heating effects and magnetisation response of magnetic nanoparticles associated with living cells

Dr. Neil Telling

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

Wednesday, April 27th

Induced magnetism in exfoliated graphene via proximity effect with yttrium iron garnet thin films

Dr. Mario Amado-Montero

Device Materials Group, University of Cambridge

Friday, May 20th

Evolution of nanostructures: XANES spectroscopy studies

Dr. Félix G. Requejo

Instituto de Investigaciones Fisicoquímicas Teóricas y Aplicadas (INIFTA), CONICET and Dept. Physics. Fac. de Cs. Exactas. Universidad Nacional de La Plata (UNLP), 1900 La Plata. Argentina

Tuesday, May 17th

Photophysics and applications of transition metal dichalchogenide monolayers fabricated via liquid phase exfoliation

Dr. Víctor Vega Mayoral

Jozef Sefan Institute, Ljubljana, Slovenija

Wednesday, May 18th

Title: Electrical transport through monolayers of colloidal nanoparticles

Dr. Christian Klinke

Institute of Physical Chemistry, University of Hamburg, Germany

seminars

Thursday, May 26th

Coexistence of superconductivity and ferromagnetism in boron-doped microcrystalline diamond

Dr. Tomas Samuely

Department Condensed Matter Physics, Institute of Physics of the Faculty of Science, P.J. Safarik University in Kosice, Slovakia

Friday, May 27th

Modeling of photophysics and energy transfer in organic semiconductors

Dr. Sergei Tretiak

Theoretical Division, Center for Nonlinear Studies and Center for Integrated Nanotechnologies, Los Alamos National Laboratory, Los Alamos NM, USA

Monday, June 20th

Mineral self-organization in a lifeless planet

Prof. Juan Manuel García Ruiz

Instituto Andaluz de Ciencias de la Tierra, CSIC, Granada

Friday, June 24th

How to Harvest Sunlight Efficiently with Quantum Dot-Sensitized Oxides

Dr. Enrique Cánovas

Max Planck Institute for Polymer Research, Mainz, Germany

Wednesday, June 29th

Prospects in single- and multiple-particle quantum electronics: from geometric-phase engineering to entanglement

Dr. Diego Frustaglia

Dep. Física Aplicada II, Universidad de Sevilla, Spain

Friday, July 1st

In-situ scanning probe microscopy

Dr. Bas Hendriksen

Formerly at Radboud University, Nijmegen, The Netherlands

Friday, July 15th

Redox functional nanomaterials for sensing and bottom-up nanonetwork formation encapsulating metallic nanoparticles

Dr. Amalia Rapakousiou

Nanosciences and Catalysis, I.S.M, University of Bordeaux

Nishihara's laboratory, The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-0033, Japan

Friday, July 22nd

Photophysics of the two-dimensional semiconductor MoS2

Dr. Christoph Gadermaier

Department of Complex Matter, Jozef Stefan Institute, Ljubljana, Slovenia

Tuesday, July 26th

Transport characteristics of all-organic radicals and spin-spin interactions

Prof. Herre van der Zant

Technical University of Delft, The Netherlands

Tusday, September 20th

Graphene on a piezoelectric substrate

Prof. Fernando Sols

Dpto. Física de Materiales, Universidad Complutense de Madrid

Friday, October 7th

Magnetic singularities in magnetic films investigated with x ray microscopy

Dr. Salvador Ferrer

Alba Synchrotron Light Source

Tuesday, October 11th

Engineering Excitons and Plasmons on C60 crystals at the Atomic Scale

Dr. P. Merino

Max Planck Institute for Solid State Research, Stuttgart (Alemania)

Thursday, October 20th

Neglected tropical diseases: the philanthropic research

Dr. Jorge Alvar

Drugs for Neglected Diseases initiative (DNDi), Geneva

Friday, November 11th

Photochemical/spectroscopic studies in turbid and scattering media

Dr. Kyril M. Solntsev

Senior Staff Scientist at OLIS, Inc. and Senior Research Scientist at Georgia Tech

Wednesday, November 16th

Monte Carlo modelling of exciton and charge transport processes in organic photovoltaics

Stavros Athanasopoulos

Departamento de Física, Universidad Carlos III de Madrid, Avenida Universidad 30, 28911 Leganés, Madrid (Spain)

Friday, November 25th

Spin and heat transport in graphene-based nanodevices

Dr. Juan F. Sierra

Catalan Institute of Nanoscience and Nanotechnology (ICN2), CSIC and The Barcelona Institute of Science and Technology, Campus UAB, Barcelona 08193 (Spain)

Tuesday, November 29th

Molecularly imprinted polymers: synthetic receptors for selective extractions and beyond

Dr. Antonio Martín-Esteban

Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria (INIA). Carretera de A Coruña km 7. 28040 Madrid (Spain)

Thursday, December 1st

Current status and challenges ahead in p-electron molecular magnetism and superconductivity - fullerenes and polyaromatic hydrocarbons

Prof. Kosmas Prassides

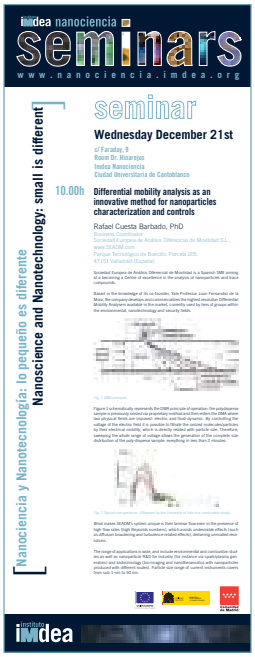
WPI-Advanced Institute for Materials Research, Tohoku University, Japan

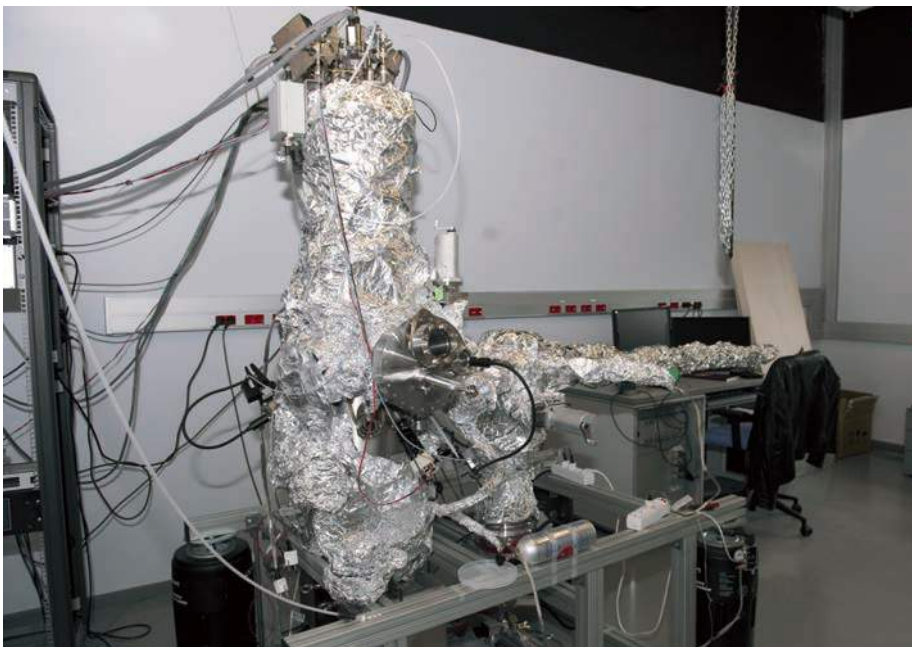
Wednesday, Decembrer 21st

Differential mobility analysis as an innovative method for nanoparticles characterization and controls

Rafael Cuesta Barbado, PhD

Sociedad Europea de Análisis Diferencial de Movilidad S.L., Parque Tecnológico de Boecillo. Parcela 205. 47151 Valladolid (Spain)





3.5. Projects

3.5.1. International programmes

3.5.1.1. H2020

NOCANTHER

Nanomedicine upscaling for early clinical phases of multimodal cancer therapy

Funding: H2020-NMP-2015-two-stage n° 685795
Duration: 2016-2020
IMDEA Research Team: Prof. Rodolfo Miranda (PI), Dr. Alvaro Somoza (PI)
http://www.nocanther-project.eu/

The NoCanTher consortium aims to scale-up a magnetic nanoparticle formulation based on iron oxide and assess it in a clinical study for the treatment of pancreatic cancer with an alternating magnetic field generator. The combination of the particles and the magnetic field at the tumoral area will increase the temperature inducing the death of tumoral cells. This process is known as magnetic hyperthermia where, remarkably, cancer cells are more sensitive than healthy cells, reducing, therefore, the undesired side effects present in conventional approaches.

GRAPHENECORE1

Graphene-based disruptive technologies (GrapheneCore1)

Funding: H2020-FETFLAG-2014 Specific
Agreement: n° 696656
Duration: 2016-2018
Consortium of 153 European Partners
IMDEA Research Team: Prof. Rodolfo Miranda, Prof. Francisco Guinea, Dr. Andrés Castellanos

This project is the second in the series of EC-financed parts of the Graphene Flagship. The Graphene Flagship is a 10 year research and innovation endeavour with a total project cost of 1,000,000,000 euros, funded jointly by the European Commission and member states and associated countries. The first part of the Flagship was a 30-month Collaborative Project, Coordination and Support Action (CP-CSA) under the 7th framework program (2013-2016), while this and the following parts are implemented as Core Projects under the Horizon 2020 framework.The mission of the Graphene Flagship is to take graphene and related layered materials from a state of raw potential to a point where they can

revolutionise multiple industries. This will bring a new dimension to future technology – a faster, thinner, stronger, flexible, and broadband revolution. Our program will put Europe firmly at the heart of the process, with a manifold return on the EU investment, both in terms of technological innovation and economic growth.To realise this vision, we have brought together a larger European consortium with about 150 partners in 23 countries.

The partners represent academia, research institutes and industries, which work closely together in 15 technical work packages and five supporting work packages covering the entire value chain from materials to components and systems. As time progresses, the centre of gravity of the Flagship moves towards applications, which is reflected in the increasing importance of the higher - system - levels of the value chain. In this first core project the main focus is on components and initial system level tasks. The first core project is divided into 4 divisions, which in turn comprise 3 to 5 work packages on related topics. A fifth, external division acts as a link to the parts of the Flagship that are funded by the member states and associated countries, or by other funding sources. This creates a collaborative framework for the entire Flagship.

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. Mª 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

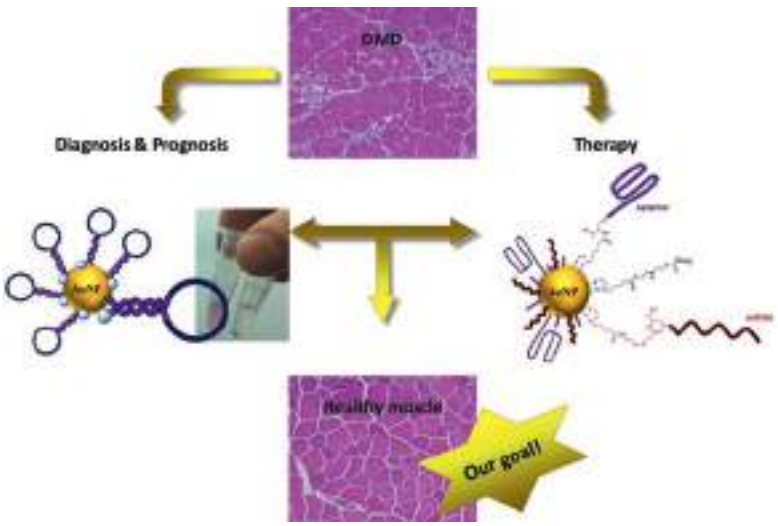
IMDEA Nanoscience with an imprinting roll to roll pilot plant participates actively in the development of multifunctional polymeric nanocomposites through surface nano engineering.

nanomiR

MicroRNAs-based nanosystems for the detection and treatment of muscular diseases

Funding: ERA-Net EuroNanoMedII (ENMII)2016 EU-Framework Programme Horizon 2020 and Ministerio de Economía y Competitividad. PCIN-2016-167
Duration: 2016-2019
Consortium of 3 European Partners
IMDEA Research Team: Álvaro Somoza (IP)
PI: Dr. Alvaro Somoza

Duchenne Muscular Dystrophy (DMD) is an X-linked muscle disorder caused by mutations in the dystrophin gene, a fundamental component of the sarcoglycan complex that protects muscle fibers from damage. Dystrophic muscles are subject to continuous waves of degeneration-coupled regeneration, leading to progressive loss of muscle mass and exhaustion of the available pool of muscle stem cells, the main cells responsible for muscle regeneration.



In this project will use functionalized gold nanoparticles to deliver in vivo therapeutic microRNAs, aptamers and drugs aimed at improving the function of muscle stem cells and increasing the regenerative capacity of dystrophic muscles. Also, gold nanosensors will be developed to monitor microRNA profiles associated with different stages of disease progression in the serum of the patients.

SOGraph

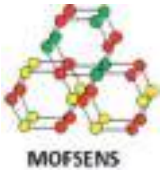
"Tailoring Spin-Orbit effects in graphene for spin-orbitronic applications"

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 **SO*graphene*** 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, SO*graphene* 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.

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)

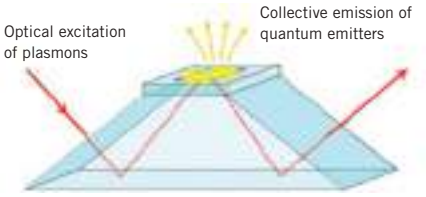
Despite of single-phase MnAl and MnBi systems being extensively studied in recent years, many fundamental questions still remain unanswered, resulting in experimental $(BH)_{max}$ values (figure of merit for assessment of the magnetic quality) well below theoretical predictions.

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.



3.5.1.2. 7FP

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 multidisciplinary 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).

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).

MINT

"Mechanically Interlocked Carbon Nanotubes"

Funding: ERC-2012-StG_20111012 nº 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.

SPINOGRAPH

"Spintronics in graphene"

Funding: FP7-PEOPLE-2013-ITN-nº 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 magnetoelectronics 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-nº 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 nº 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 of organic solar cells based on blending organic materials with carbon nanotubes. Polymer-Carbon Nanotubes Active Systems for Photovoltaics (POCAONTAS) is a training network coordinated by IMDEA Nanoscience that brings together top European players in the field of Organic Solar Cells (OSC) offering a unique opportunity for research career development. POCAONTAS will train a total of 14 researchers in the development of highly efficient and stable OSC based on tailored blends of polymers with single wall carbon nanotubes (SWNT) that are well suited for OSC due to their inherent extremely high stability, high carrier mobility and tunabilityof optical gaps.

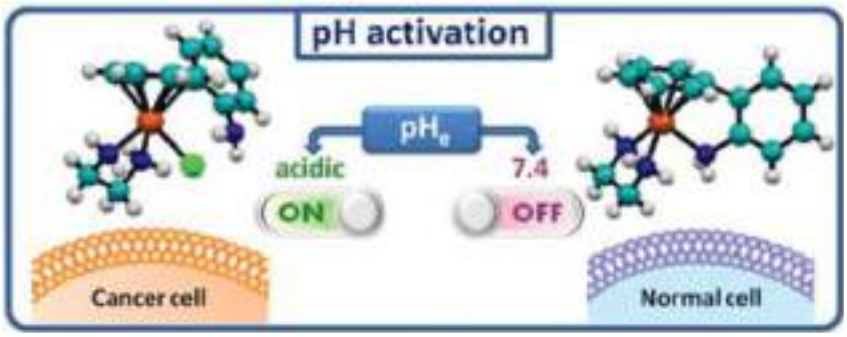
MEMOTUMCELLMACH

"Metallodrugs 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 metallodrugs 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.

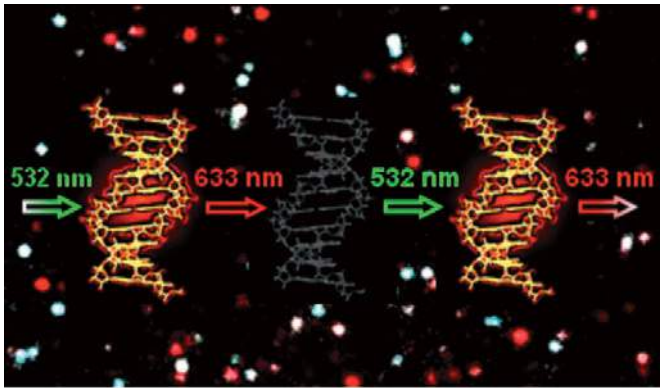


ImaginDNA

"Advanced DNA imaging: improving spatial resolution and contrast through photoswitching"

Funding: FP7-PEOPLE-2011-CIG nº 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.



AMAROUT II

AMAROUT II-EUROPE

Funding: PCOFUND-GA-2011-29180
Duration: 2013-2017
IMDEA Nanociencia as Participant

AMAROUT-II is a Marie Curie Action (PEOPLE-COFUND), granted to the Madrid Institutes for Advanced Studies network (IMDEAs), IMDEA Nanociencia among them, being IMDEA Software Institute the beneficiary. AMAROUT-II is a fellowship program designed to support transnational mobility of experienced and very experienced researchers, providing opportunities to deepen ad widen their skills and to offer attractive working conditions. Specifically, over the 2012-2017, 5-year period, AMAROUT-II has been offering 152 fellowships to experienced researchers to develop their individual research projects within the IMDEA network.

3.5.1.3. European Science Foundation

EMF-MED

"European network for innovative uses of EMFs in biomedical applications"

Funding: European Science Foundation. CMST COST Action BM1309
Duration: 2014-2018
IMDEA Researcher: Dr. Daniel Ortega
http://cost-emf-med.eu/about-cost-emf-med/

COST EMF-MED provides a cooperative framework to support the research on beneficial biological effects of non-ionizing electromagnetic fields (EMFs) and their use in biomedical applications. Research on biological effects of EMFs has traditionally focused on health risks. Inspired by promising recent studies on useful biomedical EMF interactions and applications, this Action focuses on beneficial effects, aiming for breakthrough results, new discoveries and innovative biomedical technologies. The Action will provide a better understanding of underlying physical and biological interaction mechanisms, related to both cancer and non-cancer applications, filling the gaps in present state of knowledge. Ultimately, the Action aims to contribute to development and optimization of innovative EMF-based medical devices and procedures, which will be safer, more efficient and less invasive. Interdisciplinarity of the proposed topic and significance of the expected outcomes require a concerted research network at the European level.

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

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.

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

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.

3.5.1.4. Chinese Scholarship Council

Organic position sensitive photodetectors

Funding: 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 mm [2].

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

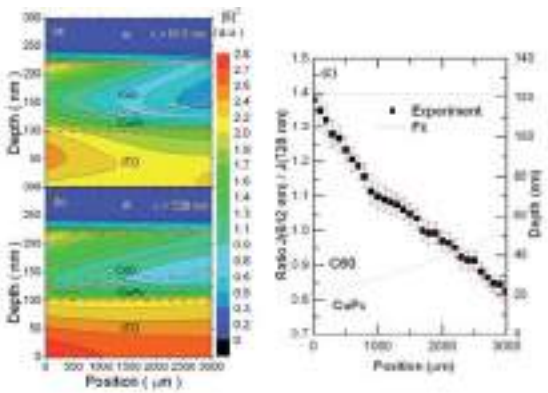


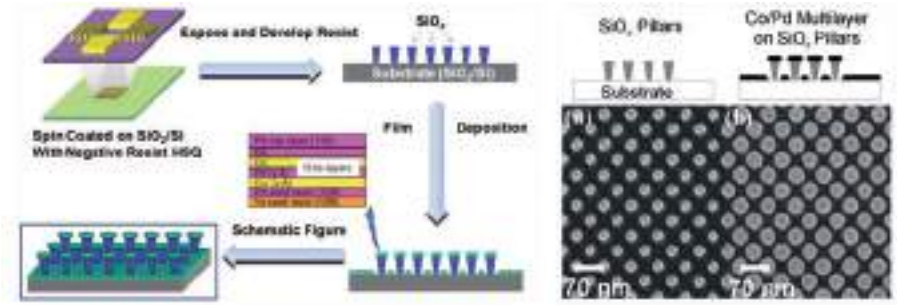
Figure. (Left) Optical modelling of the in-depth distribution of light across a multilayer photodetector. (Right) Dependence of photocurrent as a function of position.

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

Funding: 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 SiOx pillars and magnetic dot arrays

3.5.2. National programmes

3.5.2.1. Ministerio de Economía y Competitividad

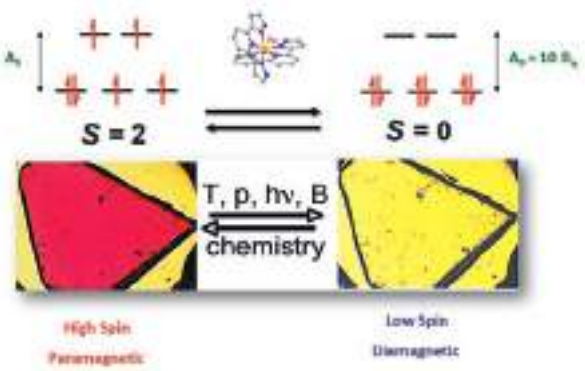
GRAPHICS

"Graphene hybrid switchable materiales"

Funding: Ministerio de Economía y Competitividad. Programa Estatal de Investigación, Científica y Técnica de Excelencia 2016. CTQ2016-80635-P
Duration: 2016-2019
PI: Dr. Jose Sanchez Costa

GRAPHICS will develop chemistry methods that will enable integrating new and tailored functionalities into novel graphene-based hybrid materials through controlling and modifying the growth and configuration of switchable Spin-crossover compounds (SCO) at the molecular level. As a result, novel 3D hybrid architectures will be obtained showing unique properties, due to the synergetic effects, unattainable in the constituent parent materials.

SCO are functional materials able to reversibly switch their spin state upon external stimuli (T and/or p, B, light irradiation or the inclusion of analytes). The reversible switch between the spin states leads to distinctive changes in various physical properties (magnetic, optical, electrical and/or mechanical), which make those exceptionally attractive as molecular sensors and for data storage (spintronics). Graphene is an exceptional substrate due to its highly specific and thin surface, low cost, versatility, enormous mechanical strength and chemical stability. It also exhibits other outstanding properties such as excellent conductance of both heat and electricity, remarkable high carrier mobility and high carrier density and easily measurable responses. The combination of both components into a hybrid nano-material will permit to discover novel properties with great potential for future technological use in the fields of energy storage, catalysis, industrial processing, environment or IC informatics technologies.



MitoDNA

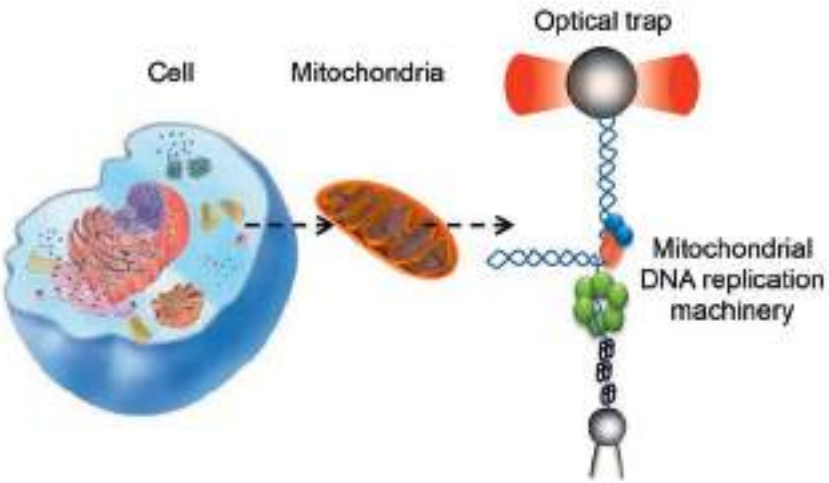
"Single molecule characterization of the coordinated protein activity dynamics at the human mitochondrial DNA replisome"

Funding: Ministerio de Economía y Competitividad. Programa Estatal de Investigación, Desarrollo e Innovación Orientada a los Retos de la Sociedad 2015 BFU2015-63714-R
Duration: 2016-2018
PI: Dr. Borja Ibarra

The aim of this project is to determine the mechano-chemical and dynamic processes that govern the operation of the molecular motors involved in the human mitochondrial DNA (hmtDNA) replication.

Mitochondria are suppliers of energy and building materials as needed by the cell and play a crucial role regulating cellular activity. Malfunction of the proteins involved in the replication of the hmtDNA promotes the onset of chronic, devastating 'mitochondrial diseases' and even cancer and premature aging. Using optical tweezers, we have recently proved the possibility to follow in real time the individual activity of each protein constituent of the mitochondrial replisome. However, these proteins do not work in isolation; their activity is highly coordinated and one protein component is regulated by that of the others. The overall goal of our current proposal is to exploit the properties of optical tweezers, to characterize the molecular basis of the dynamical and mechano-chemical processes that govern the coordinate action of the minimal protein machinery required to faithfully replicate the human mitochondrial genome. In addition, we propose to construct a new optical tweezers device with a temperature controller and use this new technology to perform in singulo thermo-mechanical studies on the mitochondrial replisome.

This proposal represents a truly novel approach to determine the mechanistic and dynamical processes governing the operation of the hmtDNA replication machinery at the molecular level and could ultimately provide insight into alternative treatment options for human patients with hmtDNA replication-related diseases.



SUPERMNAN

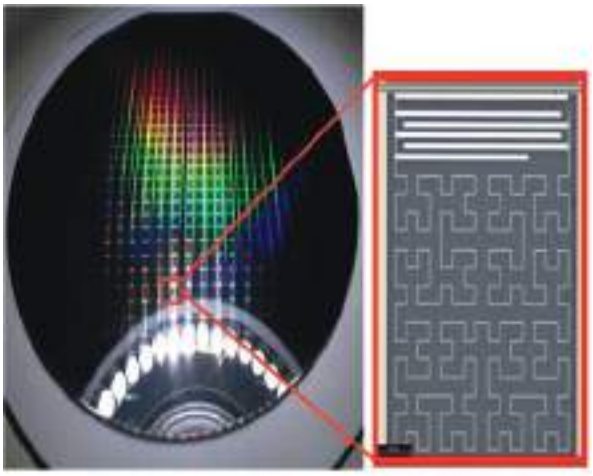
"Micro and Nanofabrication of superconducting detectors for the Far-Mid-IR in the context of SAFARI/SPICA and future missions"

Funding: Ministerio de Economía y Competitividad. Programa Estatal de Investigación, Desarrollo e Innovación Orientada a los Retos de la Sociedad 2015. ESP2015-65597-C4-3-R
Duration: 2016-2017
PI: Dr. Daniel Granados Ruiz

Direct observation in space exploration is essential for a better understanding of the universe, leading in many occasions the change of paradigm. Pushing the limits of detection of current available technologies and developing new detector technologies is therefore critical for future space missions.

This project is a coordinated project between CAB-INTA-CSIC and IMDEA-Nanoscience. It focuses on the micro and nanofabrication of superconducting detectors for the Far-Mid-IR, in the context of SAFARI/SPICA and future missions.

Next generation of astronomical observation instruments requires both large field of view cameras with millions of pixels and a low noise equivalent power (NEP) for a good signal to noise ratio in the detection. Kinetic Inductance Detectors (KIDs) are the ideal choice as they can meet these requirements and are easy to multiplex. In this context, we plan to develop hybrid narrow lines (<300nm) of TiN/Al + NbTiN to push the current state of the art of KIDs technology towards a new detection limit, to meet the baseline specifications for the next generation of FIR instruments to be consider in future missions. In addition, we plan to explore new alternative detection routes to meet these and future requirements, developing new graphene-based superconducting detectors. These detectors will be based in graphene field effect transistors (GFETs), employing superconductor metal electrodes for the emissor-collector, capable of injecting a superconducting current, high K dielectrics (HfO, AlOx) will be used for gate isolation and encapsulation.



This subproject concerns only with the micro and nanofabrication of the detectors, while the simulation, design and characterization will be carried out by the CAB in a different subproject.

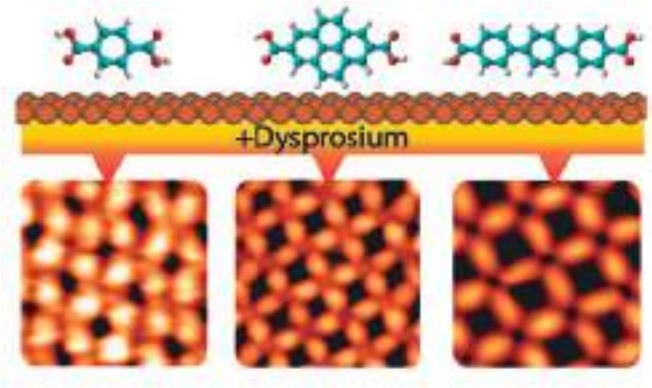
LANTHACOOR

"Lanthanide coordination chemistry on surfaces"

Funding: Ministerio de Economía y Competitividad. Programa Estatal de Investigación, Desarrollo e Innovación Orientada a los Retos de la Sociedad 2015. FIS2015-67287-P
Duration: 2016-2018
PI: Drs. David Ecija and Paolo Perna

Lanthanide metals are ubiquitous nowadays, becoming of vital relevance in different fields such as photonics, magnetism, sensing, catalysis, materials science and medicine. They find use in luminescent materials, optical amplifiers and waveguides, lasers, photovoltaics, rechargeable batteries, catalysts, alloys, magnets, bio-probes, and therapeutic agents. In addition, they bear potential for high-tech applications including high temperature superconductivity, molecular magnetic storage and magnetic refrigeration.

Here, we propose to explore lateral lanthanide coordination chemistry on metals, with the goal of designing functional nanoarchitectures and studying physico-chemical properties related to the lanthanide family at the nanoscale. Specifically, we ambition to fabricate two-dimensional metal-organic lanthanide-directed nanodesigns. To this aim, we will take advantage of a powerful instrumental methodology combining scanning tunneling microscopy with spatial average techniques including XPS, UPS, XAS and XMCD.



STM topographs of the metallo-supramolecular Dy-directed reticular networks on Cu(111).

COMIC

Advanced correlative microscopy of biological particles under mechanical damage"

Funding: Ministerio de Economía y Competitividad.Programa Estatal de Investigación, Desarrollo e Innovación Orientada a los Retos de la Sociedad 2015. MAT2015-66605-P
Duration: 2016-2018
PI: Dr. Cristina Flors Ong

In this project we focus on the development of methodology that maximizes the synergies between atomic force microscopy (AFM) and advanced fluorescence microscopy (including super-resolution, single-particle and single-cell imaging) in order to tackle more ambitious scientific questions. Building on our previous experience on correlative AFM and super-resolution fluorescence imaging, we propose here to combine these techniques simultaneously, exploit the nanomanipulation potential of AFM, develop new fluorescence labeling strategies and apply these novel methods to study complex samples that can be globally described as biological particles. Two types of biological particles will be studied as model systems: i) bacterial cells, in which we will quantitatively study the resistance of their cell wall to mechanical perturbation, and ii) virus-like particles and natural viruses, to better understand the nanomechanical properties of viral capsids and their permeability to small molecules at early stages of mechanical damage. The novel insight gained in this project will be very relevant to engineer better strategies for the delivery of biomolecules and nanoparticles into living bacterial cells, understand the mechanisms of viral infections, and design improved nanocontainers for drug delivery in advanced therapies.

MaNaTwee

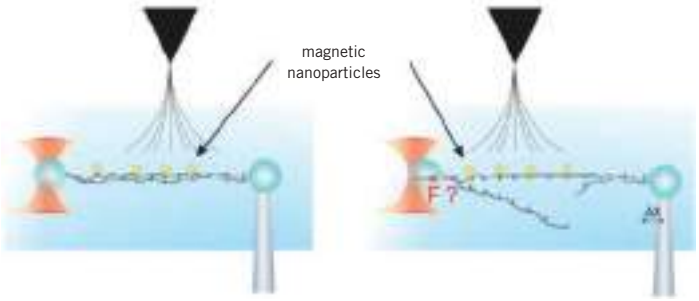
Influence of magnetic nanoparticle heatingover individual biomolecules determined by optical tweezers

Funding: Ministerio de Economía y Competitividad. Programa Estatal de Investigación, Desarrollo e Innovación Orientada a los Retos de la Sociedad 2015. MAT2015-71806-R
Duration: 2016-2018
PIs: Drs. J. Ricardo Arias González and Gorka Salas

The aim of this project is to measure, at the single structure level, the temperature profile of a single magnetic nanoparticle (NP) or of a single aggregate with activity in the cell interior considering the typical parameters that rule their excitation by remote, alternate

magnetic fields (H_{AC}-fields). In addition, to determine the influence of magnetic NPs at the molecular level inside the cell, we will use a simple biomolecule model and measure the influence of magnetic NPs over an individual DNA molecule. Experiments will be performed in vitro by means of optical tweezers and microfluidics technology which, together, will provide an unprecedented analysis.

This proposal encompasses progress in the study of nanostructures as local actuators in the fields of nanomedicine and functional nanomaterials. Considering that magnetic fields (H-fields) have a high penetration depth in biological tissues and a low physiological influence, we believe that our measurements will allow magnetic NPs to be proposed as nanoswitches that operate between the folded and denatured states of biological molecules, such as DNA and proteins. This progress may facilitate the access to highly-specific therapies based on physical action, rather than the traditional biochemical approach based on the use of drugs, with off-target effects. In addition, we expect that our results with magnetic nanostructures will pave the way to the design of active materials based on the combination of magnetic NPs and biological molecules.



Main essay in the MaNaTwee: a DNA chain doped with iron oxide magnetic NPs is subjected to an alternate magnetic field through a chemically-etched Fe-Co microwire, thus exciting heat from the NPs that triggers the DNA melting. The force at which melting is produced is measured by the optical trap, which further allows an experiment at the single-molecule level.

CARBHOM

Homogeneous Linewidth Spectroscopy of Carbon Quantum Dots

Funding: Ministerio de Economía y Competitividad. Programa Estatal de Investigación, Desarrollo e Innovación Orientada a los Retos de la Sociedad 2015. MAT2015-71879-P
Duration: 2016-2018
PI: Dr. Reinhold Wannemacher (PI)

Carbon Dots (CD) are an emerging class of carbon materials with unique properties, such as high fluorescence quantum yield, high photo-stability, wavelength tunability, stability in aqueous suspensions, non-toxicity, and bio-compatibility. They have promis-

ing applications in the fields of bio-imaging and bio-sensing, potentially replacing toxic semiconductor nanoparticles or dyes. In addition, they can be mass-produced, at low cost, from readily available and cheap biomaterials, including bio-waste. As CD are excellent donors, as well as acceptors, they are currently intensely investigated also for applications in solar energy conversion, and photo-catalysis. Moreover, CD have very recently been incorporated into processable polymers, including polymer sheets and electro-spun fibers, which further increases the palette of possible applications.

However, to fully utilize the potential of CD, it is necessary to have an in-depth understanding of their optical properties and optical interactions within the QD and with the environment, including photo-induced charge transfer. The present proposal aims at a detailed investigation of these properties using advanced homogeneous line width spectroscopic techniques, such as Fluorescence Line Narrowing (FLN), Spectral Hole-Burning (SHB), Optically Detected Magnetic Resonance (ODMR) using SHB, and Single Molecule Spectroscopy (SMS), as well as Surface-enhanced Raman spectroscopy (SERS). The proposed experiments are expected to yield detailed information on the photophysics of CD.

GOBIERNO DE ESPAÑA | MINISTERIO DE ECONOMÍA, INDUSTRIA 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 la 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.

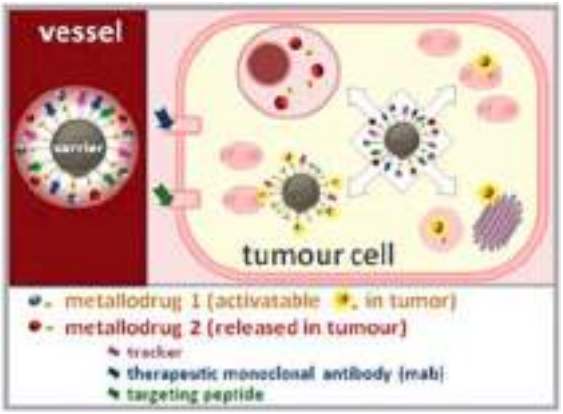
ACMENANOTOOLS

"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 entitities – 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.



GOBIERNO DE ESPAÑA
MINISTERIO DE ECONOMÍA, INDUSTRIA Y COMPETITIVIDAD

miRGold

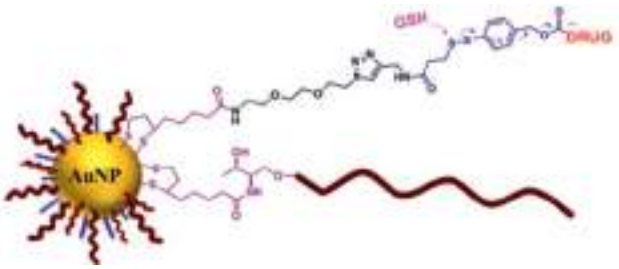
"Design and evaluation of therapeutic agents and sensors based on non-coding RNAs and nanostructures"

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 la 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 materias 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.

GOBIERNO DE ESPAÑA
MINISTERIO DE ECONOMÍA, INDUSTRIA Y COMPETITIVIDAD

CHIROSPIN

"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. 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 multidisciplanary 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 ia a collaboration between IMDEA Nanoscience and Alba Synchrotron bringing complementary expertises, in order to advance our understanding in a new multidisciplinar area, refered 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**.

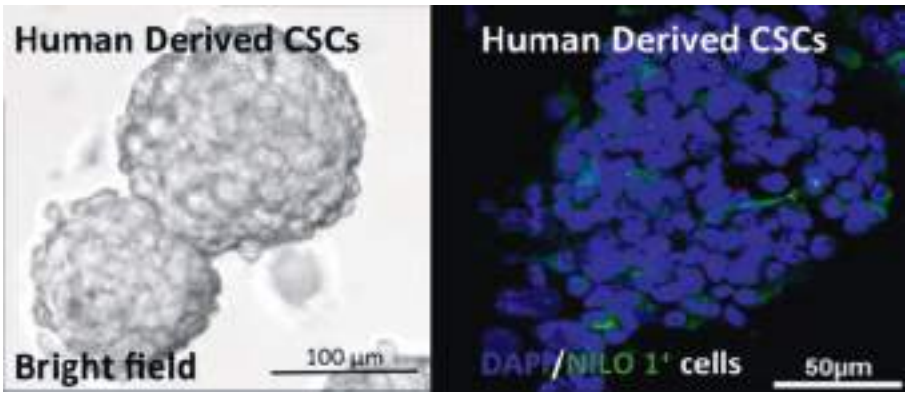
GOBIERNO DE ESPAÑA
MINISTERIO DE ECONOMÍA, INDUSTRIA Y COMPETITIVIDAD

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.

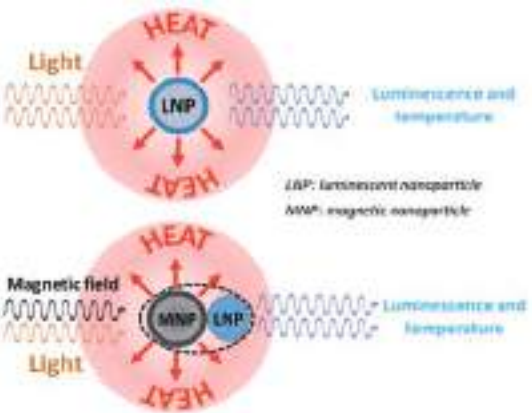
Picture of a flexible and quasi-transparent solar cell fabricated with two-dimensional semiconductors.

NANOT

"Multifunctional Nanostructuresfor 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.



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: 2014-2018
Coordinator: Prof. Rodolfo Miranda (UAM & IMDEA Nanociencia)
IMDEA Research Team: Dr. Dr. Alberto Bollero (PI), Dr. Julio Camarero (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 instititutions. 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: 2014-2018
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

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: 2014-2018
Coordinator: ICMM-CSIC
IMDEA Research Team: 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.

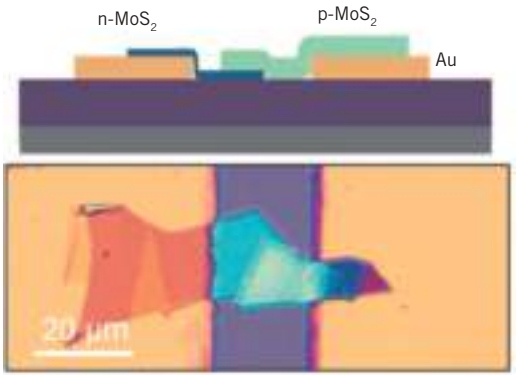
3.5.4. Foundation programmes

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.

AECC

Nanomedicine for the treatment of uveal melanoma

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 Cancer* 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 biodistibution *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.

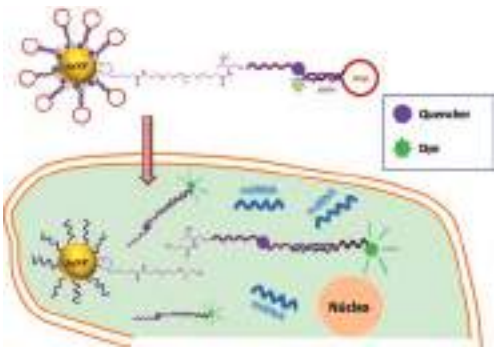


Figure 1. Detection of miRNAs using gold nanoparticles modified with molecular beacons.

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.

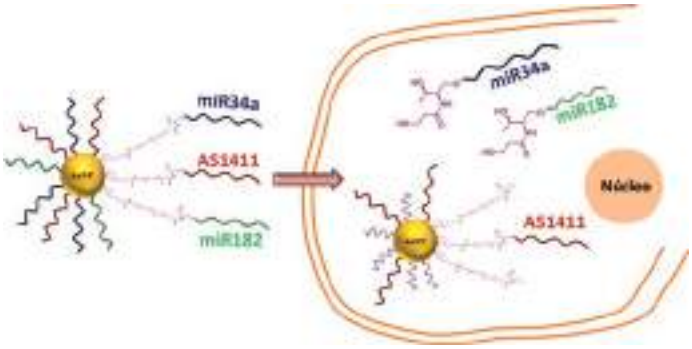


Figure2. Inhibition of microRNAs related with Uveal Melanoma using gold nanoparticles modified with nucleic acids.

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 opportunities 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.

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

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).

Neel Brown (Repsol)

2015-2016

FREENOX (Repsol)

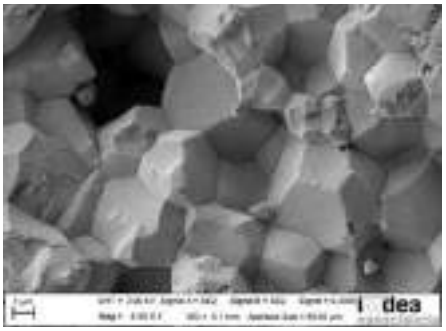
Directors: Rodolfo Miranda & Roberto Otreo
Management team: Bonifacio Vega, Mark Davies
Scientific team: Rodolfo Miranda, Roberto Otero, David Écija, Daniel Granados, Manuel Rodríguez, Miguel Ángel Niño, Paolo Perna, Fernando Ajejas, Santiago Casado, Enrico Gnecco, Rubén Guerrero.
Laboratories: Epitaxial Growth Laboratory (B35), Centre for Nanofabrication (Z03), Atomic Force Microscopy (B17).

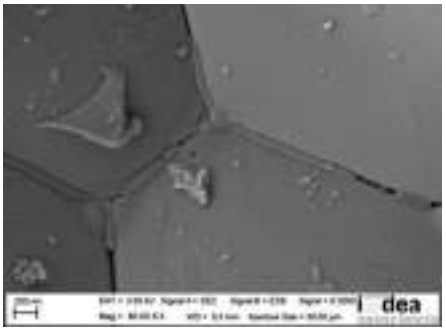
Reduction of NO_x emissions is one of the biggest challenges being faced by car manufacturers today, with tough emission regulations being enforced worldwide. Recently, this has become even more relevant with the emissions scandals that have hit some of the world's leading car manufacturers. Existing technologies available for the posttreatment 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.

FREENOX reaction chamber.



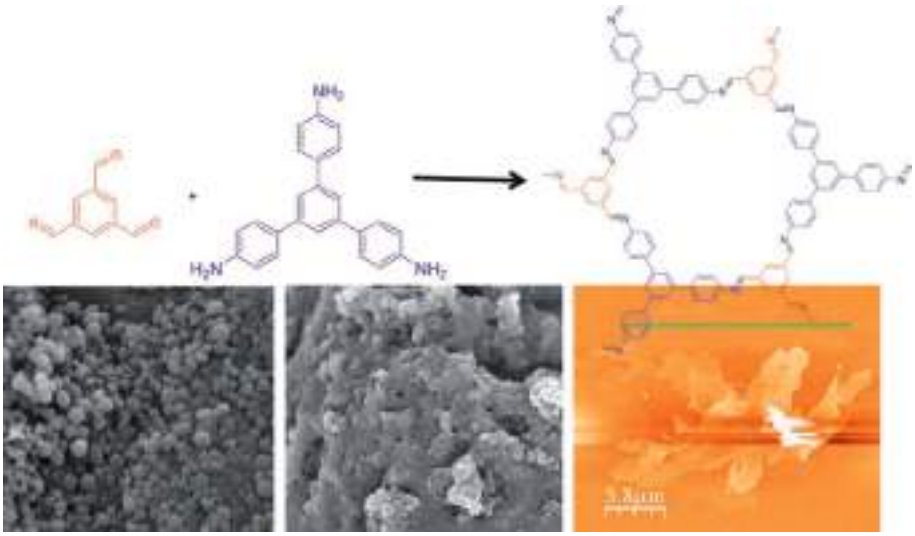


SEM images of the surface of devices prepared in the FREENOX project.

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.



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

Marie Skłodowska-Curie Actions

H2020

E-GRA-MONS OPTICS (H2020-MSCA-IF-2014 no 660732)
Dr. Daniel Cano

7FP

POCAONTAS (FP7-PEOPLE-2012-ITN no 316633)
Abasi Abudulimu, Dr. Anna Isakoba

MOLESCO (FP7-PEOPLE-2013-ITN-no 606728)
Valentina Sacchetti, Simon Svatec

SPINOGRAPH (FP7-PEOPLE-2013-ITN-no 607904)
Francesca Finocchiaro, Luis González Arraga

AMAROUT II (PCOFUND-GA-2011-291803)

Incoming Fellowships

Call 2014
Dr. David Ecija, Dr. Daniel Cano, Dr. Ruben Guerrero, Dr. Alberto Rodriguez Pulido, Dr. Jose Santos, Dr. Paramjyothi C. Nandajan, Dr. Ruben Alvarez-Asencio, Dr. Emerson Giovanelli

Call 2013
Dr. Daniel Ortega

Reintegration Fellowships

Call 2014
Dr. Agustin Molina

Call 2012
Dr. Isabel Rodriguez

The Netherlands Organization for Scientific Research (NWO)

Dr. Riccardo Frisenda, *Postdoc*
RUBICON fellowship
Dr. Enrique Burzuri, *Visitor*
VENI fellowship

Ministry of Economy, Indystry and Competitiveness

Ramon y Cajal Programme

Call 2015
Dr. Andrés Castellanos-Gómez, Dr. José Sánchez Costa

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

FPI Programme

Call 2015
Sofia Mena

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
Diego Ruiz, Noelia López, Sergio de las Heras

Spanish Ministry of Education, Culture and Sport

FPU Programme. Predoctoral Grant

Call 2013
Leyre de Juan

fellowship

Madrid Regional Government Department for Education, Youth and Sports

Programa de Ayudas para la contratación de ayudantes de investigación y técnicos de laboratorio. Fondo Social Europeo y la Iniciativa de Empleo Juvenil (YEI) de la Comunidad de Madrid.

Call 2015
Alejandra Jacobo

Basque Regional Government

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

Call 2013
Sara Hernandez

Chinese Scholarship Council

Call 2015

Liu Zhao. *China Building Materials Academy.* Four years PhD fellowship. Supervisor: F.Luo

Yue Niu. *Harbin Institute of Technology.* One year secondment. PhD fellowship. Supervisor: A. Castellanos

YanSheng Liu. *Lanzhou University.* One year secondment. PhD fellowship. Supervisors: F. Luo and R. Wannemacher

Chen Sun. Beijing Normal University. Four years PhD fellowship. Supervisor: J. Cabanillas

Call 2014

Guilin Liu. Jiangnan University. Two years secondment PhD fellowship.Supervisor: J. Cabanillas

Qi Zhang. *Nanjing University of Posts and Telecomunications.* One year secondment PhD fellowship. Supervisor: J. Cabanillas

Call 2012

Junqing Shi. *Beijing Normal University.* Four years PhD fellowship. Supervisor: J. Gierschner

Call 2011

Longfei Wu. Beijing Normal University. Four years PhD fellowship. Supervisor: J. Cabanillas

Luo Hauyu Feng. Beijing Normal University. Four years PhD fellowship. Supervisor: F.Luo

Visiting students

Catarina Castanheira Coutinho. Institute of Biomedical Sciences Abel Salazar of the University of Porto, Portugal. PhD student -Erasmus Programme. 6 months secondment. Supervisor: A. Somoza

Maria del Rayo Chávez. Instituto de Fisica "Luis Rivera Terrazas", Universidad Autónoma de Puebla, Puebla, México. PhD student. 4 months secondment. Supervisor: F. Guinea

Foad Ghasemi. Teheran University, Iran. PhD student. 6 months secondment. Supervisor: A. Castellanos-Gómez

Diana Gracheva. Samara State Aerospace University. URSS. PhD student -Erasmus Programme. 6 months secondment. Supervisor: A. Somoza

Sandeep Kumar Chaluvadi. Université de Caen – ENSICAEN, France. PhD student. 2 months secondment. Supervisor: P. Perna

Aidin Lak. 2 weeks secondment. PhD student. Istituto Italiano di Tecnologia Genova, Italy. Supervisor: F. Terán

Eliezer F. Oliveira. Univ. Estadual Paulista, Bauru, Brazil. PhD student. 3 months secondment. Supervisor: J. Gierschner

Christoph Reuter. Ulm University, Germany. Visiting BSc - RISE DAAD program. 3 months secondment. Supervisor: A. Castellanos-Gómez

Saba Shojaie Mehr. Kashan University, Iran. PhD student. 6 months secondment. Supervisor: J. Camarero

Mikhail V. Zyuzin. 2 weeks secondment. PhD student. Istituto Italiano di Tecnologia, Genova, Italy. Supervisor: F. Terán

Internships. Master students

Francisco Buendía (UAM). Supervisor: F. Terán

Christian Fernando Duarte (UFV). Supervisor: A. Somoza

Juan Martínez Rodríguez (UPM). Supervisor: A. Somoza

David García (UAM). Supervisor: G. Salas

Laura González (UC3M). Supervisor: G. Salas

Sergio González-Abad (UAM). Supervisor: A. Castellanos-Gómez

Elena López. Supervisor: A. L. Cortajarena

Javier Retortillo (UAM). (UAM). Supervisor: F. Terán

Ander Urien (UAM). Supervisor: F. Terán

Luis Vaquero-Garzón (UAM). Supervisor: A. Castellanos-Gómez

Laura Villar Gomara (UAM). Supervisor: B. Sot

BsC students

Nicole Arthur (UPM). Supervisor: F. Terán

Elena Campillo (UCM). Supervisor: F. Terán

Elena González López-Aranda (UCM). Supervisor: D. Ortega

Adrian Gudín (UAM). Supervisor: P. Perna

Álvaro Larriba (URJ). Supervisor: R. Wanemacher

Victor Marzoa (UPM). Supervisor: P. Perna

Sergio Montero (UCM). Supervisor: Supervisor: D. Ortega

Elena Plaza (UCM). Supervisor: F. Terán

Jaime Ramos (UPM). Supervisor: P. Perna

Roberto del Río (UAM). Supervisor: G. Salas

María Vacas (UAM). Supervisor: G. Salas

Laura Villar (UAH). Supervisor: B. Sot

Marcos Zan (UAM). Supervisor: G. Salas

High School Students

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

Helena Mullot
Liceo Francés, Madrid. 1 week in February 2016. Supervisor Dr. E. Giovanelli

Vildan Shenol Shevka, Irene Alonso Morillas
IES La Cabrera, La Cabrera, Madrid. 1 week in March 2016. Supervisor Dr. F. Calleja

3.7. Academic Activities

3.7.1. Theses

11.01.2016

Nanobiotechnology and Nanomaterials for Gene Expression and Bacterial Growth Control

Siamak Javani
Supervisors: Alvaro Somoza and Jose Pascual Abad

12.01.2016

Study of diatomic molecules under short intense laser pulses

Rui E. Ferreira da Silva
Supervisors: F. Martin and P. Rivierè

18.01.2016

Novel Nanostructures based on Modified Oligonucleotides

Romina Andrea Lorca Contreras
Supervisor: Álvaro Somoza

26.02.2016

Intercalation of sulfur in epitaxial graphene on ruthenium(0001) studied by means of scanning tunneling microsocopy and spectroscopy

Bernardo Gavito, Ramón
Supervisor: Daniel Granados

06.05.2016

Molecular, supramolecular and biohybrid aqueous phthalocyanine systems as photoactive materials for energy conversion and nanomedicine

Eduardo Anaya Plaza
Supervisors: Tomás Torres and Andrés de la Escosura Navazo

27.06.2016

Scattering of atoms and diatomic molecules from non-metal surfaces

Alberto P. Sánchez Muzas
Supervisors: F. Martín and C. Díaz-Blanco

18.10.2016

Advanced Sensors Platforms Based on Methalic Oxides Nanowires and plasmonic Methalic structures.

Antonio García Marín

Supervisors: José Luis Pau Vizcaíno and María Encarnación Lorenzo Abad

25.11.2016

Engineering Repeat Proteins as building blocks for functional nanostructures and materials

Sara Hernández Mejías

Supervisor: Aitziber López Cortajarena

15.12.2016

Subphthalocyanine-based systems focused on molecular photovoltaics

German Zango Casado

Supervisors:Tomás Torres and M. Victoria Martinez Díaz

15.12.2016

Synthesis and properties of photo- and electroactive tetraazaporphyrins and their performance in dye-sensitized solar cells

Javier Fernández Ariza

Supervisors:Tomás Torres and M. Salomé Rodríguez Morgade

3.7.2. Master Theses

19.09.2016

Protein modules to stabilize metallic nanoclusters: new tools for sensing and imaging

Elena López Martínez

Supervisors: Aitziber López Cortajarena and Cristina Flors

3.7.3. External Courses and Seminars

Participation in Master´s Degrees

Universidad Autónoma de Madrid

Master's Degree in Molecular Nanoscience and Nanotechnology[1]

Master in Condensed Matter Physics and Nanoscience[2]

Master´s Degree in Biophysics

Master´s Degree in Biomolecules and Cell Dynamics

Master's Degree in Biotechnology

Master's Degree in Genetics and Cellular Biology

Universidad Complutense de Madrid

Master's Degree in Medical Physics

Erasmus Mundus en Molecular nano-and biophotonics for telecommunications and biotechnologies (MONABIPHOT)

Universidad Politécnica de Madrid

Master's Degree in Advanced Materials

External Courses and Seminars

15.01.2016

Kavli Institute for Theoretical Physics (KITP), Santa Barbara, California, USA

Graphene as a membrane

F. Guinea

15.01.2016

Munster University, Munster, Germany

2D semiconductors for optoelectronics applications

A. Castellanos-Gomez

[1] Joint title: Universidad Autónoma de Madrid, Universidad de Valencia, Universidad de Alicante, Universidad de Valladolid, Universidad de Castilla-La Mancha, Universidad de La Laguna y Universidad Miguel Hernández de Elche.

[2] Joint title: Universidad Autónoma de Madrid, Universidad de Murcia and Universidad de Oviedo.

19.01.2016
Kavli Institute for Theoretical Physics (KITP), Santa Barbara, California, USA
Introduction to strains and gauge fields in graphene
F. Guinea

23.01.2016
Instituto de Ciencia de Materiales (ICMM-CSIC), Madrid, Spain
Conductive Coordination Polymers at the nanoscale: from metallic nanostructures to potential novel memristors
F. Zamora

23.02.2016
Departamento de Química. Universidad Autónoma de Barcelona, Barcelona, Spain
Más allá del grafeno: horizontes en materiales bidimensionales
F. Zamora

February 2016-
Department of Chemistry. Baker Laboratory. Cornell University, Ithaca, N.Y. USA
March 2016 *Advanced Electrochemistry*
April 2016 *Solid State Chemistry*
E. Lorenzo

01.02.2016
Universidad Politécnica de Madrid, Madrid, Spain
Tutorial on 2D crystals: synthesis, characterization and properties
A. Castellanos-Gomez

02.03.2016
Universitat de les Illes Balears, Palma de Mallorca, Spain
Phthalocyanines: old dyes, new materials. Putting color in nanotechnology
T. Torres

29.02.-03.03.2016
Institute for Physical and Theoretical Chemistry, University of Tübingen, Germany
Lecture Series: Optical Spectroscopy of Conjugated Organic Materials: Chromophores in Solution
J. Gierschner

15.03.2016
CSOM, Department of Materials Science and Engineering, Seoul National University, South Korea
Tutorial: Practical Aspects of Optical Spectroscopy - Tricks and Traps
J. Gierschner

16.03.2016
Università degli Studi di Roma "La Sapienza"
Novel edge states in graphene
F. Guinea

16.03.2016
Centro Nacional de Investigaciones Cardiovasculares (CNIC), Madrid, Spain
1st Practical School in Super-Resolution Microscopy
C. Flors

17.03.2016
Instituto Regional de Seguridad y Salud en el Trabajo, Madrid, Spain
Introducción a las Nanopartículas. Breves apuntes sobre seguridad (within the technical formation course "Riesgos que nos esperan: Nanopartículas").
G. Salas

20-30.03.2016
Global Initiative for Academic Networks (GIAN), New Delhi, India
New methods for the production and chemical manipulation of 2D nanomaterials and carbon nanotube
E.M.Pérez. Visiting only Professor for the 10-day course

24.03.2016
Ulsan National Institute of Science and Technology, South Korea
Future Lighting: Chances & Challenges of OLEDs
J. Gierschner

24.03.2016
Chemistry and Biochemistry Department, McMaster University, Toronto, Canada
An Allosteric Cross-talk Between the Activation Loop and the ATP Binding Site Regulates the Activation of Src Kinase
N. d´Amelio

24.03.2016
Center for Nanochemistry, Peking University, China
Hybrid superconducting/magnetic nanostructures and 2D materials
D. Pérez de Lara

04.04.2016
Biomagune, San Sebastian, Spain
Functionalized Nanostructures for Biomedical Applications Álvaro Somoza
A. Somoza

13.04.2016
Facultad de Farmacia, Universidad Complutense de Madrid, Madrid, Spain
Functionalized Nanostructures for Biomedical Applications
A. Somoza

18.04.2016
Universidad Politécnica de Madrid. Madrid, Spain
Imanes Permanentes y Nanociencia, Motores del Desarrollo Tecnológico (Seminarios Internacionales de Fronteras de la CC de Materiales)
A. Bollero

21.04.2016
Instituto de Física Teórica IFT, Madrid, Spain
Recent advances in graphene research
F. Guinea

27.04.2016
Centro de Investigaciones Biológicas
Functionalized Nanostructures for Biomedical Applications
A. Somoza

28.04.2016
Department of Chemistry. Baker Laboratory. Cornell University. Ithaca, N.Y. USA
Nanomaterials and Metal Complexes in (Bio) sensor Development
E. Lorenzo

29.04.2016
Universidad de Zaragoza, Zaragoza, Spain
Recent advances in graphene research
F. Guinea

09.05.2016
Centro de Física de Materiales, CSIC, San Sebastián, Spain
Desarrollos y procesos en superficies de materiales
M. A. Niño

11.05.2016
Ciclo de Conferencias y Seminarios del Instituto de Química Orgánica General (IQOG-CSIC), Madrid, Spain
Metallodrugs in cancer research
Ana M. Pizarro

19.05.2016
Istituto Italiano de Tecnología, Genova, Italy
Magnetic nanoparticles: from fundamentals to biomedical applications
F. Terán

26.05.2016
Instituto de Ciencia de Materiales (ICMM-CSIC), Madrid, Spain
From single-molecule experiments to a general framework for non-equilibrium thermodynamics
J. R. Arias-Gonzalez

02.06.2016
Instituto de Ciencia de Materiales (ICMM-CSIC), Madrid, Spain
Spatial variation of a giant spin–orbit effect induces electron confinement in graphene
F. Calleja

12.06.2016
Centro de Micro-análisis de Materiales (CMAM), Madrid, Spain
Spatial variation of a giant spin–orbit effect induces electron confinement in graphene
F. Calleja

20-22.06.2016
Conferencia Española de Nanofotónica (CEN 2016), Valencia, Spain
Synthesis and optical trapping of colloidal quantum dot-based structures
B. H. Juárez

22.06.2016

Workshop on Two-dimensional materials: Probing the limits of physics and engineering, Madrid, Spain

Exotic 2D Materials

A. Castellanos-Gomez

23.06.2016

Department of Chemistry. National University of Singapore, Singapore

Beyond graphene: Rational synthesis of 2D-polymers

F. Zamora

27.06.2016

A Journey through Carbon Nanostructures: From Fullerenes to Graphene, Symposium in Honour of Nazario Martín and Maurizio Prato, Toledo, Spain

Phthalocyanine and subphthalocyanine containing carbon nanoestructures

T. Torres

01.07.2016

College of Chemistry and Chemical Engineering of Hunan Normal University Changsha, China

Supramolecular-Driven Formation of an Elusive Phthalocyanine-C60 Fullerene Bisadduct Triad

T. Torres

06.07.2016

XXIII International Summer School "Nicolás Cabrera", Madrid, Spain

Nanomedicine

R. Miranda

13.07.2016

Universidad de Concepción, Chile

Magnetic nanoparticles for biomedical applications

G. Salas

15.07.2016

Department of Physics, University of Basel, Switzerland

Signatures of topological superconductivity in the Meissner states

L. Chirolli

22-26.08.2016

EPFL Summer School on 2D Layered Materials: synthesis, properties and applications Zermatt, Switzerland

Tutorial on 2D semiconductors for optoelectronics

A. Castellanos-Gomez

24.08.2016

Universidad Menéndez y Pelayo, Santander,Spain

Graphene and its unique properties

F. Guinea

31.08.2016-01.09.2016

Summer school of the Leibniz Institute of Condensed Matter Karpaz, Poland

Tutorial on 2D semiconductors for optoelectronics

A. Castellanos-Gomez

10-13.10.2016

Institute for Physical and Theoretical Chemistry, University of Tübingen, Germany

Lecture Series: Optical Spectroscopy of Conjugated Organic Materials: Chromophores in the Solid State

J. Gierschner

18-21.10.2016

MEDEA summer school: Ultrafast dynamics with intense radiation sources, Agios Nikolaos, Crete, Greece

Theoretical description of attosecond molecular dynamics

F. Martín

19.10.2016

Curso de experimentación en bioinorgánica, Almuñécar, Granada, Spain

Microscopía de súperresolución óp\ca de biomoléculas

C. Flors

25.10.2016

Instituto de Nanociencia y Nanotecnología, CNEA, Bariloche, Argentina

Opportunities in nanomagnetism and advanced magneto-optic based instrumentation

J. Camarero

27.10.2016
Instituto de Óptica, CSIC, Madrid, Spain
Super-resolution fluorescence microscopy: from basics to advanced applications
C. Flors

28.10.2016
Instituto de Biología Molecular y Celular. Universidad Miguel Hernandez, Elche, Alicante, Spain
Subphthalocyanines: Singular aromatic non-planar molecules. Synthesis, supramolecular organization and applications in solar cells
T. Torres

7.11.2016
Univ. Milano Bicocca, Milan, Italy
Future Lighting: Chances & Challenges of OLEDs
L. Luer

09.11.2016
Kent University, UK
Recent advances in graphene research
F. Guinea

15.11.2016
CSOM, Department of Materials Science and Engineering, Seoul National University, South Korea
From Molecules to Polymers and from Molecules to Crystals - Research Overview 2016
J. Gierschner

15.11.2016
Instituto de Ciencia de Materiales de Madrid (ICMM-CSIC), Spain
Time-reversal symmetry breaking superconductivity in Dirac materials
L. Chirolli

18.11.2016
Materials Colloquium, Department of Materials Science and Engineering, Seoul National University, South Korea
Future Lighting: Chances & Challenges of OLEDs

18.11.2016
Universitat Jaume I Castellón, Spain
Nuevas herramientas fotoquímicas para estudios biológicos a la nanoescala
C. Flors

21.11.2016
Ulsan National Institute of Science and Technology, South Korea
Controlled Light Emission in Organic Single Crystals for Optoelectronic Applications

23.11.2016
Max-Planck Institute of Solid State Research, Stuttgart, Germany
Tailoring graphene's spin-orbit coupling through heavy metal atom intercalation
F. Calleja

28.11.2016
I Jornada de Magneto-Óptica, IMA, Madrid, Spain
Tutorial de instrumentación de magneto-óptica avanzada
J. Camarero

08.12.2016
University of Marburg, Germany
Recent advances in graphene research
F. Guinea

14/12/2016
Instituto de Química Física Rocasolano, Madrid, Spain
Functionalized Nanostructures for Biomedical Applications
A. Somoza

16/12/2016
Instituto de Estructura de la Materia (IEM -CSIC), Madrid, Spain
Harder superhydrophobic soft surfaces
I. Rodriguez

3.8. Honors

Jaunary 2016

Tomas Torres

Linstead Career Award in Phthalocyanine Chemistry of the Society of Porphyrins and Phthalocyanines, Nanjing, China, 2016

Doctor Honoris Causa by the University Miguel Hernandez of Elche, Spain, 2016

June 2016

N. Martín

Doctor Honoris Causa por la Universidad de Castilla-La Mancha

J. Cabanillas

Conferred title of Visiting Professor from Nanjing Tech University

http://iam.njtech.edu.cn/en/view.asp?id=308&class=7

July 2016

John Shelnutt Young Investigator Award 2016

G. Bottari

http://www.icpp-spp.org/general/yng_inv_awrds.php

December 2016

Event: Premio Investigador Novel Experimental de la Real Sociedad Española de Física

Link: https://rsef.es/images/Fisica/ActaJurado-PdF2016.pdf

A. Castellanos-Gomez

honors

3.9. Scientific Outreach Activities

3.9.1. Talks

21.04.2016
Instituto de Ciencia de Materiales de Madrid (ICMM-CSIC), Spain

Attosecond molecular dynamics
F. Martín

21.04.2016
Fundación Ramón Areces, Madrid, Spain

Recent advances in graphene research
F. Guinea

28.04.2016
Universidad Complutense Madrid, Madrid, Spain

Nanoelectrónica y electronica molecular: Electrónica con una sola molécula
T. González

03.05.2016
Museo de San Telmo, San Sebastián, Spain

El grafeno y sus propiedades únicas
F. Guinea

23.05.2016
Presentacion del Supercomputador LUSITANIA II. Fundación COMPUTAEX. Caceres, Spain

Luz de attosegundos y HPC: construyendo la camara superlenta de la física, la química y la biología
F. Martín

25.05.2016
Fujitsu World Tour. Digital Entreprise Show 2016, Madrid, Spain

El impacto de la transformación digital en la ciencia
F. Martín

03.06.2016
Baker and Mackenzie, Madrid, Spain

Nanociencia al servicio de la sociedad - Nano-Medicina to mentors of PWN Global Professional Women's Network
A.M. Pizarro

18.07.2016
Universidad Autónoma de Madrid, Madrid, Spain

El mundo de las nanopartículas magnéticas y sus aplicaciones
A L. Cortajarena

24.10.2016
Real Academia Nacional de Farmacia, Madrid, Spain
Las "nanomáquinas" se crecen con el Nobel de Química 2016
T. Torres

18.10.2016
IMDEA Nanociencia celebrates the Nobel Prizes 2016, Madrid, Spain

The Nobel Prize in Physiology or Medicine 2016 - Yoshinori Ohsumi
Ana M. Pizarro

30.09.2016
Noche Europea de los Investigadores, MUNCYT, Alcobendas, Madrid, Spain

Una Carrera Investigadora Multidisciplinar: de la Química a la Nanomedicina
A. Somoza

30.09.2016
Noche Europea de los Investigadores, Residencia de Estudiantes del CSIC, Madrid, Spain

Una ciencia muy deportiva o un deporte muy científico
J. R. Arias-González

10.11.2016
II Semana de la Facultad de Química de la Universidad de Murcia, Murcia, Spain

Nanomateriales Multifuncionales: Nuevos Horizontes en Materiales Bidimensionales
F. Zamora

14.11.2016
Science's Week 2016 IES Maria Moliner, Segovia, Spain

Nanopartículas contra el cáncer
F. Terán

3.9.2. Media

January 2016
B. Ibarra
Spanish Biophysical Society e-Magazine
Genetics and Biophysics

June 2016
F. Martín and F. Zamora
Blog de la GEFES - RSEF
De grafito, grafeno. De antimonio,...

September 2016
Boletín RSEF
Antimoneno, nuevo material bidimensional

UAM Gazette
Antimoneno, nuevo material bidimensional para los dispositivos del futuro

Libertad digital
Científicos españoles aíslan antimoneno, un nuevo material derivado del antimonio

El Confidencial
Científicos aíslan antimoneno, un nuevo material derivado del antimonio

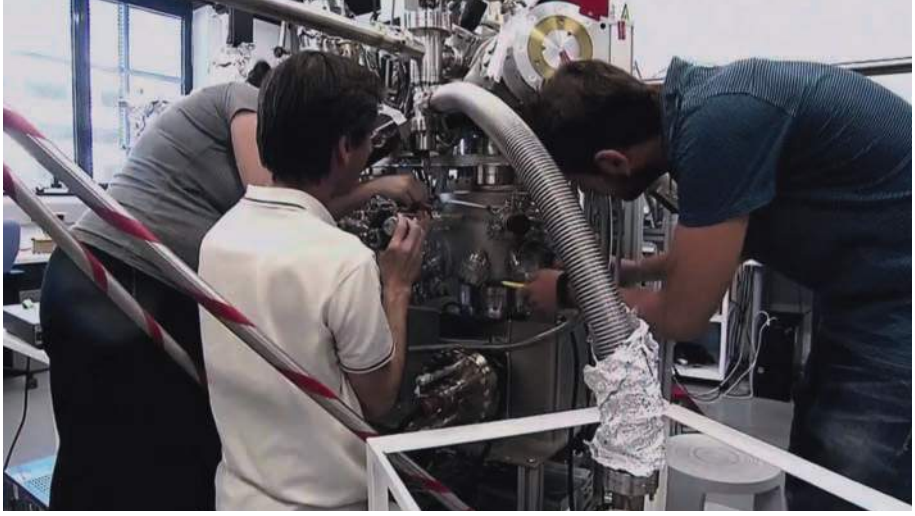
Catalunya Vanguardista
Candidato para la construcción de nuevas tecnologías

October 2016
F. Martín and F. Zamora
Agencia SINC
Nuevo método para la preparación de antimoneno

F. Martín and F. Zamora
Portal de Tecnología e Innovacion del Ministerio de Defensa
Antimoneno, un nuevo material bidimensional.

November 2016
N. Martín
Madri+d
Premio Nobel de Química

F. Martín and F. Zamora
Blogs de cultura digital e innovación- Fundación Telefónica
Antimoneno: un nuevo material bidimensional con mucho futuro



F. Martín
RNE-Radio 5 program "Entre Probetas"
Prof. Martin explains the wave-particle duality

F. Martín
Radio Extremadura program "Principio de incertidumbre"
Prof. Fernando Martin's radio interview in a popular science program

F. Martín
Agencia SINC
Observan por primera vez la onda asociada a un electrón

F. Martín
Madrimasd
Observan por primera vez la onda asociada a un electrón

F. Martín
Europa Press
Científicos españoles detectan la onda asociada a un electrón

F. Martín
ABC
Científicos de la UAM observan por primera vez la onda asociada a un electrón
http://agencias.abc.es/agencias/noticia.asp?noticia=2365928

F. Martín
La Vanguardia
Científicos de la UAM observan por primera vez la onda asociada a un electrón

F. Martín
NANOTECH WEB
Attosecond experiment monitors the birth of a photoelectron

December 2016
Jose Antonio Lopez (JAL) talks about Prof. Fernando Martin's article in Science
RNE-Radio 5 program "El Laboratorio de JAL"
Link

3.9.3. Exhibitor

25-27.07.2016
Euroscience Open Forum ESOF-16, Manchester, UK

INVITED by EU Commision to share stand: "Permanent magnets without critical raw materials"
IMDEA Nanociencia-Grupo de Imanes Permanentes y Aplicaciones A. Bollero, E. Céspedes

3.9.4. Nanociencia para todos

November 2016

XVI Semana de la Ciencia de Madrid

This year IMDEA Nanociencia celebrated the XVI Semana de la Ciencia with a variety of events; two open-days, a radio interview and even a visit from the regional television!

8th November 2016

Radio interview

Dr. Ana Pizarro joined guests UAM researcher Dr. Isabel Guillamón and Madri+d's director Dr. Federico Morán, invited by host Capital Radio to communicate to the Madrid audience the activities to be carried out in the two-week Semana de la Ciencia in the Comunidad de Madrid.

https://twitter.com/Msanmartingc/status/795927562643980289?s=08

IMDEA Nanociencia Open days

In 2016 we have received over 400 applicacions and over 180 students, teachers and citizens have participated.

11th of November 2016 - **Visitors: 72**

Our visitors (IES San Isidro, Madrid and Colegio Internacional Aravaca, Madrid) were received by Dr. Teresa González who introduced our research with the lecture entitled *Acércate a la Nanociencia: lo Pequeño es Diferente.*

Next we enjoyed showing some of our laboratories, in particular, on this day, our visitors, divided in six groups of ca. 12 people where guided through the building to take a look at the following labs:

Supramolecular Chemistry
Dr. E. M. Pérez

In the Emilio Pérez lab, Dr. Belén Nieto, Dr. Matías Blanco and PhD students Julia Villalva and Mariano Vera showed our guests how a real chemistry research laboratory works, the instruments and the materials that they use in a regular day. They finished the visit with two real experiments based on supramolecular chemistry, with really spectacular results!

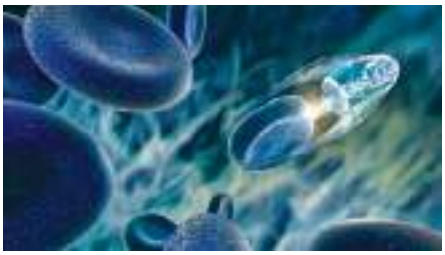
https://pbs.twimg.com/ext_tw_video_thumb/797088644888674304/pu/img/orKvi-HFBM2cD3exU.jpg

Magnetic Nanoparticles
Dr. G. Salas

In the Magnetic Nanoparticles lab, the visitors had the opportunity of learning about what magnetic nanoparticles are, which properties make them promising materials for application in biomedicine and other fields, and attended to a real *in vivo* demonstration of their preparation in the lab.

Nanomedicine
Dr. A. Somoza

Following a brief intro on the projects in which the Somoza lab is working at the moment (mirGold, NoCanther, AECC), his collaborators Dr Alfonso Latorre, Ana Belén Latorre and Beatriz Álvarez showed our visitors the exciting and extraordinary optical properties of both gold nanoparticles and (even smaller!) gold nanoclusters.



Femtosecond spectroscopy
Dr. L. Luer

Different from the other labs where the visitors could see the shapes of nano-objects, here we investigate the relation between shape and function. Since nano-objects are so small, everything happening in them is very fast. I introduced the concept of the "método murciélago": using a very fast kind of flash photography, they measured the size of nanoobjects by the time it takes for light energy to cross them, just like a bat does using sound waves.

Permanent magnets
Dr. A. Bollero

In the Permanent Magnets Lab, the visitors had the opportunity of learning about magnets and their applications. Dr. Eva Céspedes and Dr. Alberto Bollero introduced the fundamental importance of these materials in every-day technological applications. The PhD students Melek Villanueva and Javier Rial prepared some experiments with magnets. Visitors could enjoy playing with "spiky" ferrofluids and magnetic "magic" nails.

Photon STM
F Calleja

In the STM lab the visitors were guided around a Scanning Tunneling Microscope operating in Ultra-High Vacuum Conditions and at low temperature, a few degrees above the absolute zero. This instrument allows us to explore matter down to the atomic level, where quantum mechanics plays a major role. After explaining the general aspects we discussed some of our experiments currently in progress.

16th November 2016

Telemadrid visits IMDEA Nanociencia

Journalist Maria Sáiz and her team visited IMDEA Nanociencia to have breakfast with our Director, Prof Rodolfo Miranda, and researchers Dr. Julio Camarero and Dr. Emilio Pérez, live in the programme "Desayunos Contigo" in Telemadrid Channel. Journalist Maria Sáiz and her team visited also visited the Nanofemtosecond Lab where she asked our researchers Dr. Juan Cabanillas and Dr. Cristina Flors about working abroad and the role of Women in Science, respectively.

Asociación Española Contra el Cáncer and IMDEA Nanociencia

Facebook AECC

Link: https://www.facebook.com/unidoscontraelcancer

Semana de la ciencia 2016

https://www.youtube.com/watch?v=hT4CUSmDwR4

A. Somoza

Nanotechnology. A small world with big possibilities in the investigation of cancer

Gold in the fight against cancer? IMDEA senior researcher Dr. Álvaro Somoza tells us all. In this project, financed by the Spanish Association Against Cancer, Dr. Álvaro Somoza and his team develop sensors for the detection of Uveal melanoma as well as drug and nucleic acid vehicles for treatment.

18 of November 2016 - **Visitors: 70**

Following the Welcome lecture by Dr. Teresa González on the *Acércate a la Nanociencia: lo Pequeño es Diferente*), our guests (IES Manuel de Falla, Móstoles and Instituto EFA Valdemilanos, Colmenar Viejo, Madrid) visited the laboratories of Emilio Pérez and Álvaro Somoza, as well as some additional visits:

Magnetic Nanoparticles

Dr. F. Terán/ Dr. D. Ortega

At the Hyperthermia lab, visitors had the opportunity to learn about magnetic properties of magnetic nanoparticles dispersed in water, including demonstrations of magnetic hyperthermia and computational modelling of nanoparticle-mediat-

IES Manuel de Falla, Móstoles

ed heat transfer in human models. Visitors learnt about the benefit the nanomedicine and the interest of magnetic nanoparticles for biomedical applications.

Nanophotonics
Dr. R. Wannemacher

After demonstrating fluorescence of various objects in the dark laboratory with a UV flashlamp, several materials investigated in our current research and their fluorescence were shown to the visitors, such as conjugated organic crystals, conjugated organic polymer thin films and carbon nanodots. Applications of such materials for plastic lasers, sensors, and organic light emitting diodes were discussed. Measurement techniques, such as time-correlated single photon counting, and the functioning of various devices, such as spectrographs and lasers in the laboratory were explained. Senior Researcher Juan Cabanillas gave an interview on our work to the television team.

Advanced nano-optics
Dr. R. Guerrero

We show the visitors how important magnetism is in our daily lives, and how important is the size in magnetism by showing them some of the more ambitious projects developed or in development. Some examples are the application of nano-magnetism in permanent magnets, the importance of sensors and how we plan to use them to repair nerves and finally we explained the importance of topology in data storage.

Photon STM
Dr. D. Écija

In the Photon STM lab, the visitors had the opportunity of learning the fundaments of an ultra-high vacuum chamber, nitrogen and helium cryogenia, and scanning tunneling microscopy, an instrumental set-up that allows to visualize, manipulate and characterize the electronic properties atoms and molecules.

Optical Nanomanipulation
Dr. R. Arias and Dr. B. Ibarra

In the Optical Tweezer's laboratory Dr. Sara de Lorenzo explained to our visitors the optical trapping principal. They were shown the three high resolution optical tweezer setups and their exciting biological applications. They even had the opportunity to hold and examine a microfluidic chamber were the real experiments are carried out!

Nanociencia para Todos is an outreach program arisen in response to the demand on popular

Instituto EFA Valdemilanos, Colmenar Viejo, Madrid

Madrid Biotechnology Association

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 regular "Open Days" activity in which we receive mainly students from the last years of high school. In 2016 we received over **300** students, teachers and citizens.

- 13th January 2016
  IES Floridablanca, Murcia
- 29 February 2016
  IES Pradolongo Madrid
- 10th March 2016
  Colegio Retamar, Madrid
- 18th May 2016
  Universidad de Mayores de la UCM
- 2nd of June 2016
  Colegio Angel León, Colmenar Viejo
- 21st November 2016
  Madrid Biotechnology Association
  (Biotech Masters and Degree students)

November 2016

La Noche Europea de los Investigadores Madrid 2016

Una ciencia muy deportiva o un deporte muy científico.

research focus

4.1. **NOCANTHER**. Nanomedicine upscaling for early clinical phases of multimodal cancer therapy **[194]**

annual report 2016

NOCANTHER

NOCANTHER

Nanomedicine upscaling for early clinical phases of multimodal cancer therapy

Funding: H2020-NMP-2015-two-stage n° 685795
Duration: 2016-2020
IMDEA Research Team: Prof. Rodolfo Miranda (PI), Dr. Alvaro Somoza (PI)
http://www.nocanther-project.eu/

The NoCanTher consortium aims to scale-up a magnetic nanoparticle formulation based on iron oxide and assess it in a clinical study for the treatment of pancreatic cancer with an alternating magnetic field generator. The combination of the particles and the magnetic field at the tumoral area will increase the temperature inducing the death of tumoral cells. This process is known as magnetic hyperthermia where, remarkably, cancer cells are more sensitive than healthy cells, reducing, therefore, the undesired side effects present in conventional approaches.

The device used in NoCanTher to apply the magnetic field is smaller than current ones and can be easily adjusted to the different regions of the body. What is more, it can be even optimized for preclinical studies, facilitating the translation of the therapeutic approach to the clinical setting.

Along the project, different nanoparticle formulations will be evaluated using advanced preclinical models. Particularly, Patient-derived Xenographs (PDX), which are mouse models bearing human tumors obtained from patients. In the case of pancreatic tumors, this type of model is particularly relevant since the studies conducted with standard tumoral models do not correlate well with the clinical outcome.

The formulations we are considering for the preclinical studies include the combination of the chemotherapeutic drug Gemcitabine and the targeting peptide Nucant, which were evaluated during a previous European project MultiFun (Grant number: 262943). The clinical study will be carried out with the selected medical device.

upscaling for early clinical phases of multimodal cancer therapy

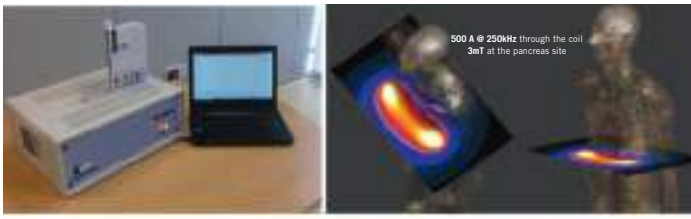
nanomedicine

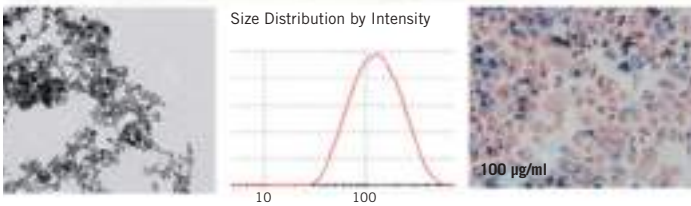
The main tasks carried out at IMDEA Nanociencia are the following:

- Coordination of the consortium.
- Preparation of a portable inductive magnetometer.
- Supervision on the quality of the nanoparticles
- Implementation of SOPs and GLP lab to handle the nanoparticles.
- Development of Computational system for the optimization of the hyperthermia treatment.

The portable inductive magnetometer developed at IMDEA Nanociencia will be used at the pilot line for the characterization of the magnetic properties of the nanoparticles.

Among the techniques employed to assess the quality of the particles we are using TEM, DLS and functional studies in cell culture. The implementation of Standard Operational Protocols (SOPs) will ensure that all the measurement are always done in the same way and can be easily reproduced at different locations such as the pilot line. Finally, the magnetic hyperthermia treatment of animals and humans will be modeled using computational systems to optimize the therapeutic effect and reduce the side effects.





The consortium is composed of eleven partners from different European countries: IMDEA Nanociencia (Spain), Biopraxis Research AIE (Spain), Immupharma PLC (UK), Chemicell GMBH (Germany), Fundación Centro Nacional de Investigaciones Oncológicas Carlos III (Spain), Universitätsklinikum Jena (Germany), Resonant Circuits Limited (UK), Fundacio Hospital Universitari Vall d'Hebron-Institut de Recerca (Spain), The Provost, Fellows, Foundation Scholars & The Other Members Of Board Of The College Of The Holy & Undivided Trinity Of Queen Elizabeth Near Dublin (Ireland), Universite Paris Diderot -Paris 7 (France) and Fundacio Privada Institut D'investigacio Oncologica De Vall-Hebron (Spain).

research facilities

annual report

2016

IMDEA Nanocienica counts on more than 5000 m^2 of research laboratories and infrastructures distributed among 5 floors, 2 of them underground. There are 35 research laboratories and 9 core scientific infrastructures in place to help create the perfect environment for multi-disciplinary research. Around 30% of the total space remains available for future growth.

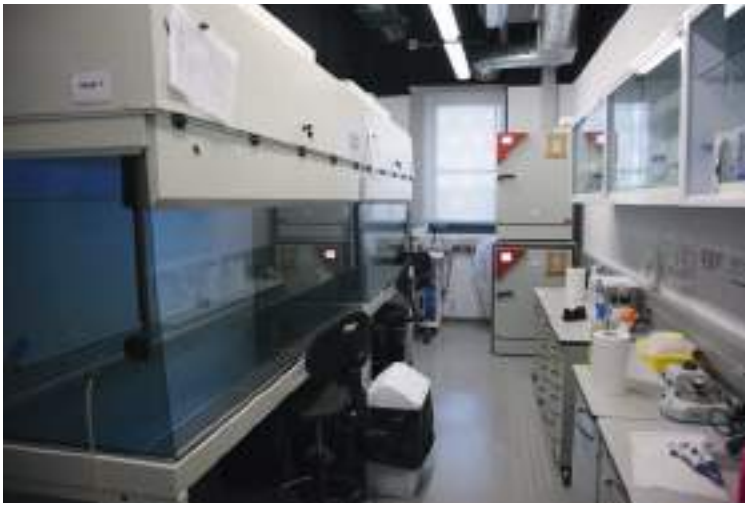
The core research infrastructures comprise:

- **Centre of Nanofabrication:** 200 m^2 clean room (ISO 6&5). Equipped with lithography tools (eBeam, FIB & GIS, Maskless Laser lithography and nano-imprinting), thin film deposition (Thermal metal evaporators, sputtering and ICP-Atomic Layer Deposition), both dry (RIE and cryo ICP-RIE) and wet etching (5 wet benches).
- **Electron Microscopy Suite:** variable pressure (10^{-4} to 400 Pa) SEM (EVO-HD) with EDS (X-Flash-430).
- **Helium liquefier plant:** 10 m^3 balloon, high pressure storage plant and two independent liquefiers (ATL160 from Quantum Designs). The average liquefaction rate is 75 l/day, servicing 20 laboratories.
- **NMR Facility:** Bruker DPX 400 MHz with a 9.4T magnet. A Double Resonance Broadband Probe can be tuned from ^{31}P to ^{15}N. Automatic carousel for 16 samples (Sample Xpress Lite).
- **Biochemistry common Lab:** Resources for cloning and gene synthesis, protein engineering, expression and purification. Characterization of conjugation and functionality, functionalisation of surfaces.

- **Cell Culture Lab:** fully equipped for animal cell culture studies. Established cell lines, primary and stem cells under BSL-2 guidelines. Maintains a cryogenic Cell Bank repository.
- **Characterisation Lab:** HPLC, UV-VIS-NIR Spectrophotometer, IR Spectrofluorometer, Confocal Raman Microscope, Circular Dichroism, H4 Hybrid Microplate Reader, Gel Doc System, Thermogravimetric Analyzer, Isothermal titration calorimeter, Centrifuge, PCR Mastercycler.
- **Nanoparticle Synthesis Lab:** Synthesis and characterization of nanoparticles and core-shell nanomaterials. Surface functionalisation with small molecules or polymers.
- **Atomic Force Microcopy Lab:** includes a JPK Nanowizard II for fluorescence&AFM. Nanotec Cervantes with jumping mode. NT-MDT Ntgra Prima used for nanotribology and nano-manipulation.

Highlighted Research Labs:

- **Scanning Tunneling Microscopy Labs:** 5 labs, underground and vibration isolated. Two LT-STM (4.2K) one with optical access for excitation & spectroscopy and an LT-STM (<1K) with a 3T magnet. All are prepared for Spin Polarized ST M, sample preparation, LEED and AES.
- **Chemical synthesis:** 7 labs for the preparation of functional molecules with a total 28 fume hoods, all fully equipped. A MerMade4 DNA synthesizer is available to prepare custom-made oligonucleotides.
- **Super-Resolution Lab:** correlative super-resolution fluorescence & AFM with subdiffraction optical spatial resolution and topography maps of the same area, developed in-house and unique in Spain.
- **Advanced Magneto-Optics Lab:** Several magnetometry home-made set-ups based on vectorial Magneto-Optic Kerr Effect allow studying the static and dynamic magnetic properties at the micro&nano scale.
- **Growth lab:** A cluster system designed in-house with 4x interconnected UHV chambers: Two for film growth by molecular beam epitaxy and sputtering, one equipped with XPS (Al K-alfa line), UPS and LEED, one dedicated to Thermal Desorption Spectroscopy.



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