foreword
During 2018 IMDEA Nanociencia has been very successful on our way to become an international reference in the field of nanotechnology. We have been awarded as a Severo Ochoa Center of Excellence at the end of 2017, being the youngest institution getting this extremely competitive award. The Severo Ochoa programme allow us to plan the development of the Institute in the medium term with a certain independence of the year-by-year basis of the standard budget that we had so far. 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, demonstrates 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.

The scientific production of the Institute has maintained a level of the order of 200 papers/year with an accumulated number of citations showing a healthy parabolic increase with time reaching 35000 by the end of the year (more than 7500 only in 2018). The institutional h index was 82.

The recruitment of new scientists has continued with a steady rate. New facilities have been installed and new labs are operational: a lab for photovoltaic energy devices, a liquefier plant to produce liquid Helium from the recovered gas, a new STEM microscope, a new X-ray diffractometer, 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 development of the Severo Ochoa Programme involves a certain reorganization of our research lines and the creation of new ones, and changes in the internal governance structure, which now includes three Deputy Directors (Scientific Strategy, Dr. Julio Camarero; Outreach, Dr. Emilio Perez and Infrastructure, Dr. Daniel Granados). Together with the Executive Manager, the Vicedirector and the Director, they form the Executive Commission managing the center.

Contemplating the evolution of the Institute in 2018 I am certain 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 an honor for me to be still part of this adventure.

Rodolfo Miranda
Director, IMDEA Nanociencia Institute
May 2019
nanoscience and nanotechnology: small is different

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overview

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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.

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.
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 m² 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.

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 incorporation 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.
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 45% (83 out of 183) which is higher than the percentage of female researchers in the EU-28. 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.

6. Severo Ochoa Programme

IMDEA Nanociencia became an accredited Severo Ochoa Centre of Excellence in 2017 by the Spanish Ministry of Economy, Industry and Competitiveness, contributing towards the national and international leadership of the Institute in the areas of Nanoscience and Nanotechnology. This award is the highest national recognition for centres of excellence in Spain and is granted after a rigorous evaluation process carried out by an international scientific committee.

The funding provided by the Severo Ochoa award is devoted to strengthen the existing interdisciplinary character of the centre and combine different types of expertise to find innovative solutions for social and economic challenges.

We are focusing our efforts under the Severo Ochoa programme in the following areas in which the research groups can make real contributions to the advancement of knowledge and technology innovation:

- Organic nanosystems for light harvesting and energy conversion
- Fundamental properties of 2D Materials
- Nanomedicine against cancer and infection
- Nanomagnetism and Critical Raw Materials
- Solid state quantum devices for information technologies

In addition to the scientific goals, the grant also enables IMDEA Nanociencia to carry out a dedicated training and recruiting programme aimed at attracting international talented researchers (Doctoral and Postdoctoral Programmes in Nanomedicine and Nanoscience, respectively; Visitors programme; In-company training on Nanotechnology programme; courses on transferable skills; workshops and seminars). It also includes a number of ambitious actions to address the gender gap and international and outreach activities.

Other key action of the project is to create a Translational Platform to encourage cross-programme collaboration for prototyping, proof-of-concept testing, scaling-up and implementation of technologies developed in order to bridge the gap between our labs and society.

Although the award is still in its early stages, the increasing presence of IMDEA Nanociencia in the media proves the impact of the Severo Ochoa accreditation on the institute.

IMDEA Nanociencia is part of the SOMM alliance (https://www.somma.es/) and supports its goals and objectives. The SOMMa mission is to internationally promote, strengthen and maximise the value of the ground-breaking research produced by the Spanish ‘Severo Ochoa’ Centres and ‘María de Maeztu’ Units of Excellence and the scientific, social and economic impact it generates.

1. SHE Figures 2015, EU Commission.
7. Management Structure

Legally Binding Governing Structure

- BOARD OF TRUSTEES
  - BOARD DELEGATE COMMISION
  - DIRECTOR
    - Rodolfo Miranda
  - VICEDIRECTOR
    - Nazario Martín
  - EXECUTIVE MANAGER
    - Bonifacio Vega

Scientific Advisory Committee

Internal Governing Structure

- DIRECTOR
  - EXECUTIVE COMMISION
  - DEPUTY DIRECTORS
  - MANAGEMENT
  - SCIENTIFIC PROGRAMMES COMMITTEE
  - RESEARCH PROGRAMMES
1. Overview

Research Programs Committee

Prof. Rodolfo Miranda

- Prof. Francisco Guinea
- Prof. J.L. Carrascosa
- Prof. José Luis Vicent
- Prof. Julio Camarero
- Prof. Isabel Rodríguez
- Prof. Daniel Granados
- Prof. Nazario Martín
- Prof. J. Gierschner
- Prof. Alberto Bollero
- Prof. Cristina Flors
- Prof. Emilio Pérez

Rodolfo Miranda
DIRECTOR

Emilio Pérez
Deputy Director
Scientific Outreach

Daniel Granados
Deputy Director
Scientific Infrastructure

EXECUTIVE COMMISSION

Nazario Martín
Vicedirector

Julio Camarero
Deputy Director
Scientific Strategy

Bonifacio Vega
Executive Manager
8. Board of Trustees

PRESIDENT OF THE FOUNDATION
Prof. Ivan Schuller
University of California-San Diego, USA

INSTITUTIONAL TRUSTEES
Prof. Rafael van Grieken
Counselor for Education Madrid Regional Government, Spain

Prof. José Manuel Torralba
General Director of Universities and Higher Artistic Teachings, Madrid Regional Government, Spain

Mr. Alejandro Arranz Calvo
General Director of Research and Innovation, Madrid Regional Government, Spain

Mr. Rafael García Muñoz
Deputy Director for Research, Madrid Regional Government, Spain

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

Ms. Mª Ángeles Fernandez Curto
General Subdirectorate for Scientific and Technical Facilities Ministry of Economy and Competitiveness, Spain

PERMANENT TRUSTEES DESIGNATED BY OTHER PUBLIC RESEARCH INSTITUTIONS

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

Mr. Fernando Temprano

ACADEMIC TRUSTEES

Prof. Carlos Andrés Prieto de Castro
Consejo Superior de Investigaciones Científicas (CSIC). Spain

Prof. Ignacio Lizasoain
Universidad Complutense de Madrid, Spain

Prof. José Manuel González Sancho
Universidad Autónoma de Madrid, Spain

Prof. Fernando Calle
Universidad Politécnica de Madrid, Spain

SCIENTIFIC TRUSTEES

Prof. Luis Echegoyen
University of Texas at El Paso, USA

Prof. Héctor Abruña
Cornell University, USA

Prof. Cayetano López
Director of CIEMAT, Spain

Prof. Miquel Salmerón
University of California, Berkeley, USA

COMPANY TRUSTEES

Ramen, S.A
Mr. Emilio Ramiro Arcas
(suplente: Ms. Silvia Cristina López Vidal)

GMV Aerospace and Defense SAU
Mr. Manuel Pérez Cortes
(suplente: Mr. Pedro Golmayor)
## 9. Scientific Advisory Committee

**Chairman: Prof. Ivan Schuller**  
Center for Advanced Nanoscience, University of California-San Diego, USA

**Prof. Héctor Abrúña**  
Department of Chemistry & Chemical Biology, Baker Laboratory, Cornell University, USA

**Prof. Johannes Barth**  
Department of Physics, Technische Universität München, Germany

**Prof. Harald Brune**  
Ecole Polytechnique Fédérale de Lausanne, Switzerland

**Prof. Yvan Bruynserade**  
Department of Physics and Astronomy, Catholic University of Leuven, Belgium

**Prof. Luis Echegoyen**  
University of Texas at El Paso, USA

**Prof. Christoph Gerber**  
Department of Physics, University of Basel, Switzerland

**Prof. Cayetano López**  
Departamento de Física Teórica UAM, IFT, Madrid, Spain

**Prof. Maurizio Prato**  
Dipartimento di Science Farmaceutiche. Universita di Trieste, Italy

**Prof. Rasmita Raval**  
Department of Chemistry, University of Liverpool, UK.

**Prof. Miquel Salmerón**  
Department of Materials Science and Engineering, Univ. of Berkeley, USA
1. Nanochemistry [16]
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Programme Manager: Prof. Nazario Martín

Research lines

**Nanocarbons and Organic Photovoltaics**
Prof. Nazario Martín

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

**Functional Nanoscale Materials and Devices**
Dr. Enrique Burzuri

**Functional Organic Materials Hybrid Nanomaterials**
Dr. Beatriz H. Juárez

**Covalent Organic Frameworks**
Prof. Félix Zamora

**Functional Organic Materials**
Prof. Tomás Torres

**Electrochemical Biosensors**
Prof. Encarnación Lorenzo

**Switchable Nanomaterials**
Dr. José Sánchez-Costa

**Synthesis of magnetic nanoparticles**
Dr. Gorka Salas

**Biosensors**
Prof. José Manuel Pingarrón
About the programme

This programme deals with the design and synthesis of molecular nanostructures and nanomaterials, their spectroscopic characterization, in particular, their time-resolved optical response, and their self-assembly at surfaces. The expertise required includes the functionalization of different nanoforms of carbon, namely fullerenes, carbon nanotubes and graphene, metal-organic frameworks, spin-cross over architectures, organometallic compounds and semiconducting quantum dots to be self-organized on surfaces by means of covalent or supramolecular approaches and the implementation of various spectroscopic techniques, including spectroscopy of single molecules. Among the objectives of the Programme in basic science one may cite the characterization (and understanding) of the interaction light-organic molecules at the time scale of femtoseconds (both theoretically and experimentally at IMDEA) and the exploration of the time scale of the few femtoseconds into the attosecond (at least theoretically). The properties of prototype solar cells at very long time scales (ms) will be also explored experimentally. The practical objective is the use of this information, if possible, for the corresponding optimization of functional organic devices, such as organic solar cells, as well as the preparation of a variety of materials for hole and electron transport, respectively, in perovskite-based solar cells.
Nanocarbons and Organic Photovoltaics

GROUP LEADER

Prof. Nazario Martín
Research Professor
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POSTDOCS

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University of Texas at El Paso, USA

Dr. José Santos
Durham University, UK

PhD STUDENTS
Javier Urieta
Valentina Sacchetti
Eider Sánchez

Research Lines

1. Fullerenes as a singular curved scenario:
   Discovering new reactions on Fullerenes!


2. Supramolecular Chemistry of Fullerenes.
   Concave-convex Supramolecular Interactions


Group webpage:
http://www.nazariomartingroup.com
3. **On-Surface Chemistry. Exploring the 2D World Wonders**

Finding new concepts and unprecedented reaction pathways for organic molecules is enabled by ultra-high vacuum deposition on top of 2D substrates. This relatively new chemistry field allows an a la carte bottom-up design and synthesis of graphene nanoribbons and other carbon nanoforms. This line of work is carried out in collaboration with our colleagues at IMDEA Dr. David Écija and Dr. Roberto Otero. Currently, two drafts are under preparation.

4. **Hole and Electron Transport Materials for Photovoltaic Applications**

Martin’s group is also engaged in the preparation of a variety of Hole Transporting Materials (HTMs) as well as Electron Transporting Materials (ETMs) for perovskite solar cells. These materials have been able to reach values as high as 20%. This work has been carried out with Prof. Nazeeruddin in the EPFL (Switzerland). For recent results, see: *Angew. Chem. Int. Ed.* 2016, 55, 6270; *Adv. Energy Mater.* 2017, 7, 1601674; *Adv. Energy Mater.* 2017, 1601102; *J. Mater. Chem. A*, 2018, 6, 5944–5951; *Adv. Funct. Mater.*, 2018 -DOI: 10.1002/adfm.201801734. An EU patent (Application No. PCT/IB2016/057475) was obtained.

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**Highlight**


A systematic study of the effect that heteroatom-containing central scaffold (N, O, or Se) wields on the photovoltaic efficiency is investigated and compared with their sulfur analogue. The new star-shaped derivatives endowed with three-armed triphenylamine moieties show C3 symmetry and a remarkable performance. This work highlights that chalcogenide-based derivatives are promising hole-transporting material candidates to compete efficiently with spiro-OMeTAD.
Chemistry of Low-Dimensional Materials

GROUP LEADER

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POSTDOCS

Dr. Manuel Vazquez
University of Trieste, Italy

Dr. Amalia Rapakousiou
University of Tokyo, Japan

Dr. Teresa Naranjo
IMDEA Nanociencia, Spain

PhD STUDENTS

Leyre de Juan
Sofia Mena
Julia Villalva
Mariano Vera
Sara Moreno
Tomas Nicolás
Ramiro Quirós

TECHNICIAN

Christine Marie Arenas

Group webpage:
http://nanociencia.imdea.org/chemistry-of-low-dimensional-materials/home
Research Lines

Our group has interests in three main research lines:

1. Novel methods for the chemical modification of carbon nanotubes: We have developed methods for the synthesis of rotaxane-type derivatives of SWNTs, the first example of mechanically interlocked derivatives of SWNTs (MINTs, see Chem. Eur. J. 2017, 23, 12681 for a review). MINTs show fundamentally different properties from other types of SWNT derivatives, which might have implications in the reinforcement of polymers (ACS Nano 2016, 10, 8012), catalysis (Nat. Commun. 2018, 9, 2671), and sensing.

2. Chemistry of 2D materials: We are developing improved methods for production of ultrathin 2D materials and van der Waals heterostructures through liquid phase exfoliation from their bulk sources (Nat. Commun. 2017, 8, 14409). From these suspensions, we build functioning (opto) electronic devices using dielecrophoresis (Nanoscale 2018, 10, 7966). Finally, we are interested in fundamental problems in the chemistry of 2D materials, such as chemoselectivity (Nano Lett. 2016, 16, 355).

3. Fundamental principles of supramolecular chemistry: Lastly, we are very interested in measuring and understanding noncovalent forces, which underlie all the results of the previous two lines. For example, we have developed a method for the determination of association constants of small molecules towards SWNTs and unveiled the different contributions to the stability of the complexes (Chem. Sci., 2015, 6, 7008-7014 and Chem. Eur. J. 2017, 23, 12909-12916). Optical tweezers (OT) are one of the most successful single-molecule force spectroscopy techniques, to the point of Arthur Ashkin being awarded with the Nobel Prize for Physics 2018, for their use to study biophysics. In these two papers, we use OT to study synthetic supramolecular systems for the first time (Chem. Sci. 2017, 8, 6037-6041 and Nat. Commun. 2018, 9, 4512).
Functional Organic Materials
Hybrid Nanomaterials

GROUP LEADER

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Researcher ID:
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L-5896-2017

PhD STUDENTS

Héctor Rodríguez
(co-supervised with Dr. R. Arias)

Diego Ruiz

Andres Solana

Belen Ortiz
(co-supervised with Dr. R. Arias)

Group webpage:
http://nanociencia.imdea.org/semiconductor-nanoparticles-group/group-home
Research Lines

1. The main research line includes the synthesis of colloidal nanocrystal (mainly semiconductor nanocrystals or quantum dots in 0, 1, and 2D as well as hybrid systems) with the aim to design rules for optimal nanocrystals performance.


2. Functional materials for nanothermometry based on semiconductor nanocrystals. Among the fabricated systems for nanoscale thermal monitoring we focus on the synthesis of nanocrystals with adequate size and surface treatment for luminescence nanothermometry in the NIR range, where light attenuation in tissues is minimized and higher sensitivity can be achieved. (Advanced Functional Materials 27 (6), 2017, Nanoscale 9 (7), 2505-2513, 2017, Advanced Functional Materials, 28, 52, 1806088, 2018).

Syntheses of metal sulfide nanocrystals (NCs) by heat-up routes in the presence of thiols yield NCs arrangements difficult to further functionalize and transfer to aqueous media. By means of different NMR techniques, and exemplified in Ag₂S NCs, a metal-organic polymer formed during the synthesis acting as ligand has been identified as responsible for such aggregation. We have developed a new synthetic hot-injection strategy to synthesize Ag₂S NCs easily ligand exchangeable into water. Furthermore, the hot-injection route allows a straightforward Selenium treatment of these cores that yields NCs with improved optical properties and better resistance to oxidation, as demonstrated by X-Ray absorption experiments.
**Functional Nanoscale Materials and Devices**

**GROUP LEADER**

**Dr. Enrique Burzurí**  
Position: Assistant Research Prof. (tenure track)  
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Researcher ID: M-3501-2015

Group webpage:  
Research Lines

Our group has interests in three main research lines:

1. **2D and 1D materials:** We are interested in the fundamental properties of 2D materials and their integration into (opto)electronics and spintronics devices. We have assembled scalable nano-transistors based on franckeite heterostructures obtained by liquid-phase exfoliation (*Nanoscale* 2018, 10, 7966). We are also involved in the controlled positioning of 1D SWNTs in complex devices. We have fabricated Physically Unclonable Functions (PUFS) (*ACS Appl. Nano Mater.* 2019, DOI: 10.1021/acsanm.9b00322) and field-effect transistors with chemically modified SWNTs selectively positioned by dielectrophoresis (*Angew. Chem. Int. Ed.* 2017, 56, 12240).

2. **Magnetism of molecular materials:** We are also very interested in fundamental studies of the magnetism of molecules and other nanoscale materials (coordination polymers, 2D materials, mechanically interlocked magnetic molecules). For example, we have studied the magnetism of cylindrite van der Waals heterostructures down to the 2D limit (*2D Mater.* 2019, Accepted). We have also studied the magneto-electronic response of Fe-based coordination polymers to volatile organic molecules.

3. **Molecular spin QBits:** Finally, we are exploring the incorporation of SWNT-magnetic molecule hybrids into superconducting circuits as spin QBits for quantum computation.

*highlight*

Franckeite is a natural **van der Waals heterostructure** with interesting semiconducting and optoelectronic properties. Here we develop a scalable technique to assemble field-effect transistors with nanoscale precision based on franckeite flakes exfoliated in liquid phase. This fast technique can be extended to other 2D materials and low dimensional objects. See: *Nanoscale* 2018, 10, 7966.
Covalent Organic Frameworks

**GROUP LEADER**

Prof. Félix Zamora  
Associate Research Professor  
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**PhD STUDENTS**

David Rodríguez

Group webpage: https://www.nanomater.es
Research Lines

Our research group is developing the chemistry of low dimensional materials. The research activity deals with the preparation and characterization of nanomaterials with multifunctional properties:


- Two-dimensional materials based on inorganic crystals such as graphene, boron nitride and antimonene: Our aim is to provide novel synthetic routes for the production of suspensions and the characterization of these materials on surfaces [Adv. Mater. 28, 6332–6336 (2016); Angew. Chem. Int. Ed. 55, 14345-14349 (2016)].


Molecular wires are essential components for future nanoscale electronics. However, the preparation of individual long conductive molecules is still a challenge. MMX metal–organic polymers are quasi-1D sequences of single halide atoms (X) bridging subunits with two metal ions (MM) connected by organic ligands. They are excellent electrical conductors as bulk macroscopic crystals and as nanoribbons. However, according to theoretical calculations, the electrical conductance found in the experiments should be even higher. A novel and simple drop-casting procedure to isolate bundles of few to single MMX chains is demonstrated. See Adv. Mater. 2018, 30, 1705645.

Highlight

Functional Organic Materials

GROUP LEADER

Prof. Tomás Torres Cebada
Associate Senior Scientist

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ASSOCIATE SCIENTIST

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POSTDOCS

Dr. Maxence Urbani
University of Toulouse, France

Dr. Miguel García Iglesias
Universidad Autónoma de Madrid, Spain

Group webpage:
http://www.phthalocyanines.es/
Research Lines

Our research focuses on the preparation and study of molecular materials based on porphyrinoids (phthalocyanines (Pcs), subphthalocyanines (SubPcs), porphyrins, etc.).


2. Our group is also active in the area of photodynamic therapy (PDT), in which Pcs are used as photosensitizers for singlet oxygen generation (two international patents issued – PCT/EP 16168476.6, 2016 and PCT/EP16177001.1, 2016). We have also successfully used SubPcs in PDT of cancer (\(Adv. Funct. Mater., 2018, DOI:10.1002/adfm.201705938\)).

3. Finally, our group is investigating the use of porphyrinoids in nanotechnological spaces, such as the development of novel photovoltaic materials. In this context, we have prepared self-assembled ferroelectric molecular materials based on SubPcs, which also present conductivity properties (\(Sci. Adv., 2017, 3, e1701017\)), or expanded porphyrinoids able to self-organize on metal surfaces (\(J. Am. Chem. Soc., 2017, 139, 14129\)).
Electrochemical Nanobiosensors

GROUP LEADER

Prof. María Encarnación Lorenzo Abad
Associate Research Professor

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Researcher ID:
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Group webpage:
http://www.uam.es/gruposinv/biosens/
Research Lines

The group has interest in the following research lines:

1. Nanomaterials for Biosensor development: We have developed amperometric (bio)sensors with improved performance by the inclusion of nanomaterials, such as nanodiamonds, graphene, carbon nanotubes, carbon dots (Sensors and Actuators B. 2018, 267, 533; Sensors and Actuators B. 2018, 257, 226 and Reference Module in Chemistry, Molecular Sciences and Chemical Engineering. (2017). ISBN 97801240954722016, 236, 773) and gold nanoparticles. These nanomaterials have also been chemically modified (Nano Research, 11 (2018) 6405).

2. Electrochemical indicators for DNA biosensors: the group has pioneering works in Spain concerning the development of redox indicators of hybridization event. These indicators have been successfully applied in the development of very selective DNA biosensor and of biosensor for the detection of gene mutations associated to important human diseases, such as CF. In particular we have recently employed successfully metallacarboranes (Chem. Eur. J. 2018, 24, 2) as redox indicators in DNA biosensor for the detection of different gene mutations.

3. Nanomaterials for the development of supercapacitors: Lastly, we are very interested in the application of 2D nanomaterials for the fabrication of energy storage devices. For example, graphene decorated SiC nanomaterial (graphene@SiC) (fabricated via an adiabatic process), has been physicochemically characterised then applied as a supercapacitor material and as an anode within a Li-ion battery (LIB) (Journal of Carbon Research. 2017, 3, 20).

Switchable nanomaterials

GROUP LEADER

José Sánchez Costa
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POSTDOCS

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Federal University of Pernambuco, Brasil

PhD STUDENTS
Estefanía Fernandez-Bartolomé
Esther Resines

Group webpage:
http://www.nanociencia.imdea.org/switchable-nanomaterials-group/group-home
Research Lines

At the Switchable NanoMaterials group (SNM) we are mainly focused on the development of metal-based coordination complexes at the macro- and nanoscopic scale for their technological application in the fields of quantum computing, spintronic and sensing devices. Besides, we are interested in developing novel dynamic molecules sticker by soft interactions capable to act as porous materials for energy storage. Our multidisciplinary approach is based on three major themes:

1. **Iron-based Spin Crossover (SCO) Switchable coordination complexes**: The SCO phenomena remain one of the most spectacular forms of a switchable material (https://doi.org/10.1016/j.crci.2018.04.004). At the SNM we are using these materials as pillars for the synthesis of smart gasses and small volatile organic compounds (VOCs) sensors.

2. **Functional Metal-Organic Frameworks, MOFs**: MOFs are extended molecular materials formed by metal ions bridged by ligands, thus creating voids to absorb guest molecules. We are interested on increasing the selectivity of the MOF through tuning the shape and size of the pores and/or through the inclusion of specific receptors (Chem. Commun., 2018, 54, 5526).

3. **Non-porous architectures acting as porous compounds**: In contrast to MOFs, while 1D and 0D discrete compounds are non-porous by nature, in some cases they can behave as porous materials and absorb guest molecules as we have recently shown for a fullerene molecular-based structure (ACIE, 2019, 131, 8, 2332-2337, 10.1002/ange.201812419). Besides, some of us have demonstrated the potential use of low dimension materials constructed using SCO as metal centres (JACS, 2014, 10.1039/C8CC01561A). This remarkable result led us to consider the great potential that these structures have for the development of advanced sensors.

A novel extended triazole-based ligand (PM-Tria) has been synthesized and an unprecedented MOF 3D architecture has serendipitously been formed by assembling iron(II), PM-tria ligand and fluoride anions. This MOF contains a perfectly linear one-dimensional \{(Fe(II))-F\} bridging chain that shows an antiferromagnetic behaviour. Furthermore, the structure is compared with a 14th century mosaic found in the Alhambra Palace in Granada showing a surprising symmetry resemblance. See Chem. Commun., 2018, 54, 5526.
Synthesis of Magnetic Nanoparticles

GROUP LEADER

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Research Lines

We work in the synthesis of magnetic nanoparticles for various applications.

Our research is mainly focused in the preparation of magnetic hybrid nanostructures that could be used for medical imaging and treatment of tumors. That includes understanding the procedures that lead to well controlled inorganic hybrids that can respond different stimuli and developing general synthetic routes for different magnetic materials. Magnetic nanoparticles are being extensively studied worldwide as contrast agents for medical imaging and as nanoheaters under alternating magnetic fields. Many intrinsic and extrinsic factors (e.g. size, crystallinity, magnetism, aggregation, colloidal stability, dispersion medium, applied field, interactions with biological media) can influence the efficiency of nanoparticles in biomedicine. Another topic of interest, also for biomedical applications, is the use of hybrid magnetic nanocomposites as antibacterial agents, given the growing concerns about bacterial resistance and the lack of alternatives to antibiotics.

We are also exploring the use of magnetically recoverable nanocatalysts for environmental applications. Magnetic nanostructures offer the possibility of acting as catalysts or as platforms that allow the recovery of a bound catalyst.

Magnetic nanoparticles (MNPs) are being widely used in the form of aqueous colloids for biomedical applications. In such colloids, nanoparticles tend to form assemblies, either aggregates, if the union is permanent, or agglomerates, if it is reversible. These clustering processes have a strong impact on MNPs’ properties that are often not well understood. Here, we study the impact of MNPs clustering on their magnetic and heating properties. In addition, a model system with MNPs of two different sizes coated with three different molecules has been characterized and the results used to support the ideas reviewed. See Nanotechnology 2019, 30, 112001.
**Biosensors**

**GROUP LEADER**

**Prof. José Manuel Pingarrón**  
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**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.

**Group webpage:**  
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programme

Time Resolved Spectroscopies

Programme Manager: Prof. Johannes Gierschner

Research lines

Photophysics of Organic and Hybrid Supramolecular Nanosystems
Prof. Johannes Gierschner

Nanooptics and Nanoacoustics
Prof. Reinhold Wannemacher

Pump-probe Photoinduced Absorption Spectroscopy
Dr. Juan Cabanillas González

Nanostructured Photovoltaics
Dr. Enrique Cánovas

Femtosecond Spectroscopy on Molecular Systems
Prof. Larry Luer

Time-resolved X-ray Spectroscopy in Biological and Chemical Catalysis
Dr. Dooshaye Moonshiram
About the programme

The programme deals with phenomena in which either the (acoustic or optical) radiation or the matter are confined at sub-micrometre dimensions. In nanoacoustics, phase-sensitive acoustic microscopy, imaging, and non-destructive testing are developed, while the field of nanophotonics is both a Nobel Prize-winning science and a multibillion-dollar industry, underpinning applications such as telecommunications, data storage, and materials processing. Nanostructures and nanostructured materials exhibit fascinating optical response, and nanoscale optics have already shown many surprises, such as extraordinary optical transmission, superlensing, giant field enhancement, optical trapping, and imaging with resolution far beyond the diffraction limit. Researchers in this Programme have also explored semiconductor materials as advantageous candidates to be the physical basis of storage and manipulation of quantum information. The growth and characterisation of semiconductor nanostructures, and photonic devices, such as LEDs, Lasers, pillars and photonic crystal cavities is also relevant for activities in Programme 1). The scientists in this Programme have also developed optical microscopy in the near and far field, optical spectroscopy with coherent and nonlinear techniques, Raman and FTIR spectroscopy and spectroscopic SNOM.
Photophysics of Organic & Hybrid Supramolecular Nanosystems

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SECONDMENTS
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Giovanny Carvalho dos Santos
São Paulo State University (UNESP), Brazil

Group webpage:
Research Lines

Our research is dedicated to the understanding of the photophysics of organic and hybrid supramolecular nanosystems. The ultimate goal, i.e. unbiased, targeted design of tailor-made systems for optoelectronics or life science, can only be reached in an interdisciplinary manner, which we tackle in an integrative spectroscopic & computational approach, based on a strong background in chemistry & materials science.

Current Interests


highlight

Highly efficient organic photocatalysts for visible light-driven atom transfer radical polymerization are discovered via a computer-aided-design strategy by in-depth combined experimental and theoretical investigations. The studies revealed that the unique combination of efficient generation of long-lived triplet excited states, strong reducing power of the triplet state, high stability of radical cations and broad, strong visible-light absorption are the origins of the outstanding photocatalytic activities of the optimized compounds. *Nat. Catal.* 2018, 794.
Pump-probe Photoinduced Absorption Spectroscopy

GROUP LEADER

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Group webpage:
http://nanociencia.imdea.org/organic-photophysics-and-photonics/group-home
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 interchain interactions. Suppression of loss mechanisms like exciton-exciton annihilation, (J. Phys. Chem. C 2016, 120, 11350–11358) or polaron absorption (Adv. Funct. Mater. 2018, 28, 1705824) and promotion of strong host-guest interactions on polymer mixtures (Macromolecules 2015, 48, 8765–8772) are crucial for outstanding light amplifying properties.

2. Conjugated polymer waveguides and laser resonators. We use soft nanoimprint lithography to transfer patterns onto flexible substrates subsequently coated with conjugated polymer. (Sci. Rep. 2016, 6, 34565). 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 line is carried out in collaboration with the group of Nanostructured Functional Surfaces at IMDEA Nanociencia.

3. 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 (Sens. Actuators B: Chem. 2016, 236, 136–143) or liquid phase (Sci. Rep. 2017, 7, 46269). For this purpose we exploit the luminescent properties of conjugated polymers, organic dyes and porous metal-organic frameworks processed in films and composites (Materials 2017, 10, 992).

Selecting suitable hosts for green laser emission guest polymers like F8BT remains challenging, with efficient Förster resonance energy transfer and high photoluminescence quantum efficiency being necessary, but not sufficient criteria. We demonstrate that hosts with short time, charged state absorption (upper panels) quench gain whereas hosts that delay charge generation (lower panels) allow lasing. (See: Adv. Funct. Mater. 2018, 28, 1705824).
Femtosecond Spectroscopy on Molecular Systems

GROUP LEADER

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Research Lines

- **Transient absorption spectroscopy** across all relevant time scales in organic optoelectronic devices and their components.

- Advanced matrix based methods for spectral decomposition to quantify **complex photophysical pathways**.

- Main goal: Finding **dominant loss pathways** giving industrial and academic partners **design rules** to improve their devices.

- Main topics: **organic photovoltaics, photocatalysis**.

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**Highly efficient organic photocatalyst found by computer modeling. A collaboration with University of Ulsan (South Korea).** *(Nature Catalysis 1(10), 794-804 (2018))*

All-organic self-assembling nanoparticles allow stable, efficient, and easily controllable photocatalytic water splitting. In a collaboration with Seoul National University, we showed that the high efficiency is due to ultrafast triplet generation, outperforming charge separation, a prominent parasitic process in the catalytic cycle (Submitted, 2019).

Geminate recombination losses can be predicted by simple experiments. In an in-house collaboration with Prof. Nazario Martin and with the University of Wurzburg, we showed that in photovoltaic donor-acceptor blends, geminate recombination losses, that require femtosecond spectroscopy to be determined, can be predicted by Marcus theory using simple experiments. This has been shown in a class of donor materials prepared by R. Sandoval-Torrientes, group of N. Martin, *(J Mater Chem. C, 2019, DOI: 10.1039/C9TC00862D)*.
Nanooptics and Nanoacoustics

GROUP LEADER

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(co-supervised with Dr. Luo Feng)

Group webpage:
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Research Lines

1. We are studying the photocatalytic, charge and energy transfer properties of carbon-based nanomaterials (carbon dots, graphene) in close collaboration with the groups of Isabel Rodriguez and Feng Luo, IMDEA Nanociencia.

2. 2) We study amplified spontaneous emission and lasing and perform low-temperature spectroscopy down to 1.5 K of crystalline and amorphous conjugated organic and hybrid materials in close collaboration with the groups of Dr. J. Cabanillas and prof. J. Gierschner at IMDEA Nanociencia. We also investigate the photophysics of carbon nanomaterials.

3. 3) We investigate fluorescent and electrochemical sensors in close collaboration with the groups of Prof. E. Lorenzo and Dr. Cabanillas at IMDEA Nanociencia.

4. We employ high-frequency ultrasonic waves (20-500MHz) for sensing using coaxial probes and combine ultrasonic vibrations (100 kHz-6 MHz) with force microscopy for imaging and manipulation of friction on the nanoscale.

Mechanical wear is often evidenced by the formation of ripples on surfaces of contacting bodies. Using an atomic force microscope (AFM) we have shown that, on the nanoscale, this wear process can be suppressed by the application of ultrasonic vibrations. At the same time the friction coefficient is strongly reduced compared to its value without applying any vibrations. See: ACS Nano 2015, 9, 8859-8868.
Nanostructured Photovoltaics

GROUP LEADER

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Research Lines

Interfacial charge carrier dynamics in donor-acceptor systems
Controlling electron transfer in nanostructured donor-acceptor systems is a key target for developing high efficiency photovoltaic and photocatalytic devices. We are interested on unraveling the fundamentals of these critical processes at quantum dot-metal oxide interfaces (see e.g. ACS Nano 11(5), 4760, 2017; JPCL 10, 1431, 2019).

Charge carrier transport in nano-structured systems
Efficient charge carrier motion is a prerequisite in order to exploit nanostructured systems in solar energy conversion schemes. The nature of charge transport can be unraveled by THz spectroscopy, which is capable of characterizing the photoconductivity of a sample with sub-ps resolution and in a contactless fashion. By this method we have been able to demonstrate free carrier (band-like) charge transport in hybrid perovskites (JPCL 6(24), 4991-4996, 2015) and metal organic frameworks (Nature Materials 17, 1027-1032, 2018).

Third generation photovoltaics
A conventional 2-level solar absorber suffers from two intrinsic major energy loss channels: (1) its inability to absorb photons with energy less than the material absorption threshold and (2) the waste of photon energy when photons with energies above the absorption threshold are absorbed (cooling). Part of our research efforts are focused on engineering nanostructured systems for diminishing those energetic losses towards breaking the 30% Shockley-Queisser limit photoconversion efficiency barrier (see e.g. JPCL 8(12), 2654 (2017); Nano letters 18(8), 5111, 2018).

Band-like charge carrier transport in a semiconducting metal organic framework
Inorganic semiconductors as silicon are at the core of modern electronics; they are highly crystalline and good conductors of electricity. As a drawback, they are costly to produce. An historical low cost alternative are organic-based semiconductors as e.g. polymers, however, most organic based materials are poor electrical conductors. In this work we developed and characterized a novel low cost organic-based material (a highly crystalline metal-organic framework) that behaves electrically as inorganic semiconductors, i.e. an excellent conductor of electricity. These results open the path for exploiting these class of materials as active elements in electronic devices (Nature Materials 17, 1027-1032, 2018).
Time-resolved X-ray Spectroscopy in Biological and Chemical Catalysis

GROUP LEADER

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Group webpage:
http://nanociencia.imdea.org/home-en/people/item/dooshaye
Research Lines

Our research group is focused on the development and application of advanced spectroscopic tools for the design of active catalysts for water oxidation, proton reduction, and methane to methanol production processes. Currently the development of artificial photosynthetic assemblies and biological mimics of naturally methane oxidizing enzymes is of great interest, and has drawn significant attention by exploring molecular catalysts based on 3d transition metal complexes. However in spite of emerging design principles, there is an urgent need to correlate the performance and stability of a catalyst to its geometric structure and electronic configuration for its rational development.

In this regard, we are interested in the development of static and time-resolved X-ray based spectroscopic approaches, including X-ray absorption (XAS) and X-ray emission spectroscopy (XES), to understand the critical electronic, energetic and geometric requirements of the water splitting and methane oxidation reactions necessary for achieving economically feasible catalysts. Our research is particularly oriented towards ultrafast pump (laser), X-ray (probe) studies of metal noble-free photosensitizers, and multimolecular photocatalytic systems for artificial photosynthesis in the femtosecond-microsecond time regime. Combined analysis of experimental data on structures, electronic configurations and spin states provide valuable information to understand the operation mechanism.

Synchrotron-based techniques employed in our group are complemented with laboratory-based spectroscopic methods such as UV-Visible spectroscopy, Resonance Raman, Electron Paramagnetic Resonance, Optical transient absorption spectroscopy, and Atomic Force Microscopy. Our studies involve the interplay of several disciplines including synthetic inorganic chemistry, electrochemistry, kinetics, and spectroscopy.
Surfaces and Low dimensional Materials

Programme Manager: Prof. Rodolfo Miranda

Research lines

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

Photonic STM
Dr. Roberto Otero

Graphene
Prof. Francisco Guinea

Topological surfaces states in quantum materials
Dr. Manuela Garnica

Molecular Electronic
Prof. Nicolas Agrait

Modelling
Prof. Fernando Martín

Surface Reactivity
Prof. Juan M. Rojo

SNOM
Dr. Daniel Granados

Theoretical Study of Molecules on Surfaces
Prof. Manuel Alcamí

Programme:
Surfaces and Low dimensional Materials
About the programme

The use of advanced microscopies and spectroscopies with atomic resolution is essential to characterize matter at the nanoscale. The scientists involved in this programme develop at IMDEA advanced Scanning Probe Microscopes, mostly STM, AFM and Photoelectron Microscopy to investigate problems such as the epitaxial growth of graphene, the chemical functionalization of graphene, the design of metal-intercalated graphene heterostructures, the characterization of topological insulators, the self-assembly of molecules at surfaces, the on-surface synthesis of nanomaterials from molecular precursors, the design of surface-confined metal-organic architectures, the in-situ fabrication and response of nano-catalysts, the realization of scanning tunnelling spectroscopy and inelastic scanning tunnelling spectroscopy at the level of single molecules, the investigation of tip-induced electroluminescence or the spin polarized imaging of magnetic nanostructures. Friction at the nanoscale and theoretical modelling are also involved. Activities of this programme have implications for aeronautics, electronic, magnetic, sensory, and energy applications.
Scanning Probe Microscopies and Surfaces

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Group webpage:
Research Lines

The use of advanced microscopies and spectroscopies with atomic resolution is essential to characterize matter at the nanoscale. Our main tool for studying nanostructures at the atomic scale is low temperature scanning probe microscopy. The microscopes enable us to image, manipulate, and detect the local properties of nanoscale objects with picometer resolution under extreme conditions, i.e. in ultra-high vacuum, at temperatures down to 700mK and in magnetic fields up to 3T. We measure electronic, vibrational and optical excitations, magnetic interactions and forces, manipulate single atoms and molecules to assemble functional nanostructures.

We investigate problems such as the epitaxial growth of graphene, its spatially-resolved electronic structure or its chemical functionalization, the investigation of tip-induced electroluminescence of molecules, its Kondo response or the spin polarized imaging of magnetic nanostructures.

- 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

High yielding and extremely site-selective covalent functionalization of graphene. We describe a method to functionalize graphene covalently with 92% yield and 98% site-selectivity and strict spatial periodicity on the nanometer scale. This method could be extended to other functional molecules. Fig. 3

(a) STM image (17 _ 12 nm , Vb = +1.7 V, I = 10 pA) acquired after exposing the sample at 374 K to 1080 L of CH3CN. (b) STM image of the same area at different tunnelling parameters (17 _ 12 nm , Vb = +2 mV, I = 800 pA). The magenta and green circles highlight single or triple functionalized HCP-Top areas.
Group Leader

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PhD Students

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(co-supervised with Dr. Calleja)

Pablo Casado
(co-supervised with Dr. Garnica)

Cosme González
(co-supervised with Dr. Calleja)

Research Lines

The group is working on the characterization by means of low temperature scanning tunnelling microscopy and spectroscopy (LT-STM/STS) the surface of epitaxial 2D materials and topological insulators.

Chemistry on graphene
The group is working on the characterization by means of low temperature scanning tunnelling microscopy and spectroscopy (LT-STM/STS) the surface of epitaxial 2D materials and topological insulators.

Group webpage:
http://www.imdeananociencia.org/nanoscale-imaging-of-2d-materials/group-home
Tuning the electronic structure of graphene
We have been working on the growth of graphene on different transition metals and the resulting crystallographic and electronic properties. The intercalation of foreign atoms between graphene and the substrate opens the way for further tune the properties of the graphene overlayer (2D Materials 5, 035029 (2018)).

Superconductivity
We have been exploring the superconductivity on thin films and the interaction with electron acceptor molecules.

Integration of graphene in devices
Taking advantage of the clean room facilities of the Campus of Excellence UAM-CSIC located in the building of IMDEA Nanoscience, we have investigated the manufacture of electronic devices with graphene. (ACS Applied Materials & Interfaces 10, 8190 (2018) & ACS Applied Materials & Interfaces 10, 6805 (2018)).

Left panel of the image: STM image (6 nm × 8 nm) of two TCNQ-CH2CN molecules and one TCNQ on gr/Ru for negative bias voltage (Vb = −1.7 V, It = 5 pA). Total corrugation in the image is 240 pm. The inset shows the simulated STM image of a TCNQ-CH2CN on gr/Ru for negative bias (Vb = −1.7 V, It = 5 pA). Upper left panel: Top view of the most stable adsorption configuration on the gr/Ru(0001). The molecule is adsorbed on the bridge position with the cyanomethylene end pointing toward the FCC-top areas (FT) of the moiré pattern. Lower left panel: Lateral view of the most stable configuration. The cyanomethylene group is located on top of the TCNQ and points toward the vacuum.

We show that, against the classic view of carbon as a catalyst poison, nanostructured graphene monolayer epitaxially grown on Ru(0001) promotes a chemical reaction that would hardly take place under noncatalyzed conditions. The graphene layer promotes the reversible formation of a C–C bond between –CH2CN and TCNQ through three effects. First, it allows for an efficient charge transfer between the ruthenium substrate and the reactants, thus favoring changes in carbon hybridization; second, it holds the –CH2CN reactants in place [1] and allows the reduced TCNQ to diffuse freely on the surface; and last, it avoids the reaction between the TCNQ and the Ru(0001) surface. The product of the reaction is a contorted TCNQ-CH2CN conjugate, which, when adsorbed on gr/Ru, does not present a magnetic moment. The reaction is fully reversible by injection of electrons from the STM tip at voltages >+1.7 eV, upon which both reagents are recovered. One can think of TCNQ as a chemical “mop” with which the –CH2CN addends can be removed from the graphene surface, a cleaning operation that is otherwise impossible without decomposition of the graphene layer, even at temperatures as high as 600 K. On the other hand, the TCNQ/TCNQ-CH2CN pair can be viewed as a reversible magnetic switch controlled by a chemical reaction. (J.J. Navarro et al., Science Advances 4, eaau9366 (2018)).
Spin-Polarized low T STM

GROUP LEADER

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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).

We report on a controlled method to fabricate in-situ a superconducting (SC) nanostructure at the apex of the standard W tip of a Scanning Tunneling Microscope (STM) by pulsing the voltage on metal-supported graphene. We have characterized the SC properties of the resulting tip as a function of temperature and magnetic field, obtaining a transition temperature of 3.3K and a critical field well above 3T. The SC tip is stable and achieves atomic resolution. The non-SC tip can be recovered by controlled voltage pulsing on a clean metal surface. The present result should be considered when studying zero-bias features on graphene-based systems by means of STM. Submitted to APL.

a) STS spectrum showing the superconducting gap at 1.1K of a functionalized tip. b) Histogram of gap width obtained for 83 different SC tips, recorded on different surfaces (different color) at 1.1K. c) Temperature evolution of gap width and corresponding BCS fit.
Topological surfaces states in quantum materials

GROUP LEADER

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Research Lines

Our research interests deal with 2D materials and new topological states of matter. In recent years, topological materials have attracted a wide range of attention not only for the possibility to study many aspect of fundamental physics but also because of their potential to realize novel effects in spintronic or a new type of topological qubit. Our research methodology can be divided in two phases:

- **Synthesis of predicted topological materials based on TMDs.** We synthesize islands to few-layers of TMDs on well-chosen substrates by well-control molecular beam epitaxy procedures in ultra-high vacuum. TMDs possess a variety of polytypic structures such as 2H, 1T and 1T', with distinct electronic properties ranging from Weyl/Dirac semimetals (e.g. PtTe$_2$, IrTe$_2$, MoTe$_2$), quantum spin Hall insulators (e.g. 1T'-WTe$_2$, 1T'-MoTe$_2$) as well as superconductor candidates (e.g. PdTe$_2$, MoTe$_2$, IrTe$_2$) opening the possibility to explore a new platform for exotic topological superconductivity.

- **In-situ characterization of novel topological semimetals.**

The characterization of the samples is done by the combination of different surface science techniques, mainly scanning tunnelling microscopy, which allows us to visualize the collective phenomena presented in these materials.

We synthesize 2D-islands of MoTe$_2$ on graphene grown on the (111) face of an Iridium single crystal by molecular beam epitaxy. We can control the formation of different phases, such as the direct semiconducting hexagonal phase (2H) or the semimetallic distorted octahedral phase (1T') predicted to exhibit quantum spin Hall Effect. Interestingly, they remain decoupled from the substrate due to the weak interaction with graphene revealing their different electronic nature.

Figure. STM images of MoTe$_2$ islands grown on graphene/Ir(111). Note that the striped island in the upper right corner corresponds to the 1T' phase, while the bottom right one shows the characteristic domain walls of the 2H phase.
Group webpage:
http://ecija.hol.es
Research Lines

Our group is focused on the visualization and understanding of physico-chemical processes on surfaces, including three main lines of research:

1. **Surface-confined metal-organic materials.** Our main interest is to rationalize the coordination chemistry of functional metals like lanthanides on surfaces, creating unique architectures with advanced functionalities for sensing, catalysis, light emission and nanomagnetism.

2. **On-surface synthesis of functional nanomaterials.** Here we focus on the exploration of unprecedented chemical aiming at the design of novel 2D soft materials.

3. **Nanocatalysis for energy applications.** We pursue the on-surface design and atomistic characterization of metal-oxide nanocatalysts of relevance for water splitting and CO2 reduction.

*Accounts of Chemical Research, 2018, 51, 365-375*

Metallo-supramolecular engineering on surfaces provides a powerful strategy toward low-dimensional coordination architectures with prospects for several application fields. To date, most efforts have relied on transition metal centers, and only recently did we pioneer lanthanide-directed assembly. Coordination spheres and motifs with rare-earth elements generally display distinct properties and structural features. The chemistry of rare-earth elements is currently receiving widespread attention, as they are key ingredients for established and emerging 21st century science and technology with relevance for energy conversion, sensing, catalysis, magnetism, photonics, telecommunications, superconductivity, biomedicine, and quantum engineering. In this Account, we review recent advances toward the design of interfacial supramolecular nanarchitectures incorporating lanthanide centers. We apply controlled ultrahigh vacuum conditions whereby atomistically clean substrates are prepared and exposed to ultrapure atomic and molecular beams of the chosen sublimable constituents. We focus on direct molecular-level investigations and in situ assembly operative close to equilibrium conditions. Our scanning probe microscopy techniques provide atomistic insights regarding the formation, stability, and manipulability of metal–organic compounds and networks. The presented accomplishments herald further advancements in metallo-supramolecular design on surfaces, with versatile nanosystems and architectures emanating from the flexible coordination spheres. The embedding and systematic rationalization of lanthanide centers in tailored interfacial environments are keys to establishing relations between structure and physicochemical characteristics toward the generation of novel functionalities with technological significance.
Fundamental Properties of Low Dimensional Systems and Quantum Materials

GROUP LEADER

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Research Lines

In our group we fabricate low-dimensional materials and quantum systems by deposition of organic and inorganic materials on solid surfaces, and investigate their unique properties by Low-Temperature Scanning Tunnelling Microscopy, Spectroscopy and Luminescence. In particular, we are interested in:

- Effects of quantum confinement within nanostructures (discretization of energy levels, quantization of effective masses). Our recent investigations have unraveled the discretization of energy levels in graphene quantum boxes and the origin of the finite mass of electrons confined in such nanostructures (*Phys. Rev. B*, submitted).

- Luminescence of single molecules excited by STM. We have added to our STM a system to collect the light emitted from the tunneling junction due to the injection of hot carriers. The experimental setup has already been tested with individual fullerene nanocrystals (*in preparation*), and we are now moving to individual molecules.

- Interaction of spin polarized electrons with organic nanostructures. The interaction between organic molecules and the electron sea at solid surfaces leads to interesting electronic phenomena such as the existence of Kondo resonances or the existence of 1D electronic channels for interfacial electrons. We intend to explore the new effects that be expected when such organic molecules are supported by substrates with a non-trivial spin texture.
Molecular Electronic

GROUP LEADER

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Research Lines

Using scanning tunneling microscopes (STMs) made in house, we assemble and study circuits formed by a single organic molecule chemically bond to two metallic electrodes. We work mainly in ambient conditions, and explore the electrical properties of these molecular circuits, including their thermopower, this is the electrical voltage created between the extremes of the molecule under a thermal gradient.

More specifically, we study:

- Electrical properties of organic molecule families: oligo(phenyl ethynylene)s, oligoynes, phthalocyanines, porphyrins... (JACS 2013, JACS 2014, JACS 2015, JACS 2018).

- Thermo power of single-molecule junctions: we explore the 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).


- Other electrode materials different from gold.

A key goal in molecular electronics has been to find molecules that facilitate efficient charge transport over long distances. Normally, molecular wires become less conductive with increasing length. Here, we report a series of fused porphyrin oligomers for which the conductance increases substantially with length by >10-fold at a bias of 0.7 V. This exceptional behavior can be attributed to the rapid decrease of the HOMO–LUMO gap with the length of fused porphyrins. In contrast, for butadiyne-linked porphyrin oligomers with moderate inter-ring coupling, a normal conductance decrease with length is found for all bias voltages explored (±1 V), although the attenuation factor (ɪ) decreases from ca. 2 nm⁻¹ at low bias to <1 nm⁻¹ at 0.9 V, highlighting that ɪ is not an intrinsic molecular property. Further theoretical analysis using density functional theory underlines the role of intersite coupling and indicates that this large increase in conductance with length at increasing voltages can be generalized to other molecular oligomers. See: J. Am. Chem. Soc. 2018, 140, 12877–12883.
Graphene

GROUP LEADER

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http://www.imdeananociencia.org/graphene/group-home
Research Lines

The main goal of the research done within the group is the development of models which describe the properties of novel two dimensional materials. The best known case is graphene, which permits the fabrication of films of widths comparable to the radius of a single atom. After the synthesis of graphene, many other two dimensional materials have been fabricated, with a broad range of properties.

Finally, layers of different materials can be combined, leading to “metamaterials” with pre-designed features.

The models developed in the group emphasize those properties which are unique to these materials, and they include geometrical and structural features, electronic properties, and the possible formation of superconducting and magnetic phases. The group also considers devices based on these materials, highlighting those with functionalities which cannot be achieved in devices fabricated using other materials.

The research being carried out is expected to be useful for descriptions of these materials at the atomic scale, and also in samples of sizes much larger than the separation between atoms. A wide variety of techniques in theoretical physics are applied, from numerical calculations to the use of topological arguments, or methods based on the renormalization group.

The models developed in the group are checked against experimental results, and they attribute to their interpretation. A significant fraction of the research done by the group is carried out in collaboration with experimental teams.

Ultrathin graphene-based membrane with precise molecular sieving and ultrafast solvent permeation. The potential of ultrathin GO laminates for organic solvent nanofiltration is demonstrated by showing >99.9% rejection of small molecular weight organic dyes dissolved in methanol. a, SEM image of an ultrathin 8-nm-thick HLGO membrane on an Anodisc alumina support. Scale bar, 1 \( \mu \)m. Inset: SEM image of bare alumina support. Scale bar, 500 nm. b, Thickness dependence of permeance for methanol, hexane, and water through HLGO membranes. Red and blue dotted lines are the best exponential fits. This work significantly expands possibilities for the use of GO membranes in purification and filtration technologies. Nature Materials volume 16, pages 1198–1202 (2017)
Modelling Physical Properties of Nanostructures

GROUP LEADER

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Research Lines

The research carried out by the group has mainly focused on:

1. The theoretical and computational modeling of photoexcitation and photoionization processes in atomic, molecular and solid-state systems induced by synchrotron radiation and ultrashort laser pulses with femto- and attosecond duration, with the aim, of imaging and controlling ultrafast electron and nuclear dynamics occurring in these systems, and

2. The study and theoretical prediction of properties of materials and nano-objects of complex molecular systems, aggregates and fullerenes, isolated or deposited on metallic and nonmetallic surfaces, with emphasis on problems with potential interest in chemistry and biology and the design of novel two-dimensional materials, including graphene.

This, in close collaboration with prestigious Spanish and international experimental groups.

The group has published more than 400 articles in international journals, among them several in the journals Science (4), Nature (2), Chemical Reviews (1), Nature Chemistry (2), Nature Physics (2), Nature Photonics (1), Nature Communications (4), Proceedings of the National Academy of Science (3), Physical Review Letters (31), Angewandte Chemie (2), Journal of the American Chemical Society (3), ACS Nano (1), Advanced Materials (1), Small (1), and Nano Letters (1) as well as several reviews and book chapters.

Advances in attosecond science have led to a wealth of important discoveries in atomic, molecular, and solid-state physics and are progressively directing their footsteps toward problems of chemical interest. In this review, we detail the application of attosecond methods to the investigation of ultrafast processes in molecules, with emphasis in molecules of chemical and biological interest. The measurement and control of electronic motion in complex molecular structures is a formidable challenge, for both theory and experiment, but will indubitably have a tremendous impact on chemistry in the years to come. Chemical Reviews 117, 10760. DOI: 10.1021/acs.chemrev.6b00453
Theoretical Study of Molecules on Surfaces

GROUP LEADER

Prof. Manuel Alcamí
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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 focused our research in this topic in donor or acceptor organic molecules as TCNQ or TTF deposited on metal surfaces.

- Carbon nanostructures (fullerenes, nanotubes and graphene), in the last years we have developed simplify models to understand the stability of charged fullerenes, fullerene derivatives (J. Am. Chem. Soc. 139, 1609, 2017) or He-decorated fullerenes.

- 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, or to determine the energy deposit in ion collisions with biomolecules.

Group webpage:
http://www.imdeananociencia.org/home-en/people/item/manuel-alcami-pertejo
programme

NanoMagnetism

Programme Manager: Prof. Julio Camarero

Research lines

Advanced Magneto-Optics
Prof. Julio Camarero

Rare-Earth free Permanent Magnets
Dr. Alberto Bollero

Growth & Nanostructuring
Dr. Feng Luo

SpinOrbitronics
Dr. Paolo Perna

Epitaxial Growth
Dr. Miguel Ángel Niño

Dynamics
Dr. Francisco Terán

Electrodeposited nanowires
Dr. Lucas Pérez
About the programme

The scientific activity of the Nanomagnetism Programme is at the forefront of both fundamental and applied research on magnetic nanostructures, dealing with the preparation and characterization of advanced multifunctional magnetic nanomaterials with enormous impact for our society, including sensing & information storage (spintronic & spin-orbitronic), energy production & conversion (permanent magnets), and biomedical (magnetic nanoparticles) applications.

We are equipped with a powerful battery of techniques that enable the investigation of many properties of multifunctional magnetic nanostructures, including both inorganic and organic materials, grown by Molecular Beam Epitaxy (MBE) or sputtering in ultra-high vacuum environment, as well as by chemical synthesis routes. These are ultrathin films, superlattices, or nanoparticles and their properties are characterized by morphological, chemical, structural, electronic, transport, and (mostly optic-based) advanced vectorial magnetometry techniques. Particular emphasis is paid to the growth, the magnetization reversal processes (in both quasi-static and dynamic regimes), and their magnetoresistance responses. Additionally, external large scale experimental facilities (i.e., synchrotron, neutron, or ion-accelerator sources) are often used to elucidate some fundamental aspects.

We aim at a better understanding of fabrication processes and physical properties of new materials and functionalities as a first step towards the development of devices with custom-chosen properties, with potential for sensing, information storage, energy, and biomedical technologies.
Advanced Magneto-Optics

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Dr. Ruben Guerrero
Institut d’Electronique Fondamentale (IEF) Universite Paris- Sud, France (co-supervised with Dr. P. Perna)

PhD STUDENTS
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Group webpage:
http://www.nanociencia.imdea.org/research/research-programs/nanomagnetism/group-of-advanced-magneto-optics
Research Lines

We design and take use of advanced magneto-optic based instrumentation for nanotechnology research and development. Research is focused on low-dimensional artificial magnetic structures, such as ultrathin magnetic films and multilayers, magnetic nanostructures, magnetic nanoparticles and adsorbed molecules, with a particular emphasis on magnetization reversal processes and magneto-resistive responses.

We aim at probing and understanding both magnetization reversal and transport properties of magnetic nanostructures by systematically tuning intrinsic parameters, such as magnetic anisotropy and magnetic coupling, and extrinsic ones, like temperature and external fields (including dynamic effects). The current activities are focused on:

Magnetization reversal and magneto-resistive studies:
- Influence of anisotropies (in-plane vs. perpendicular) & nanostructuration;
- Static vs. dynamic and thermal effects; superparamagnetism;
- Exchange bias, spin-valves, tunnel-junctions, multiferroics, nanoparticles, molecules;

Polarization dependent element-resolved x-ray spectroscopy and microscopy studies:
- X-ray magnetic circular/linear dichroism, (XMCD/XMLD);
- X-ray photoemission electron microscopy, X-PEEM;
- Soft x-ray resonant magnetic scattering & Magnetic holography imaging;

New mechanism to exchange bias a ferromagnet


Spontaneous exchange bias formation driven by a structural phase transition in the antiferromagnet

(a) Hysteresis loop of a FeCo/IrMn (FM/AFM) bilayer just after being deposited (black) and 65 h later (blue). The exchange bias developed spontaneously in only a few hours. (b) XRD θ–2θ scans of the same sample taken every 1.5 h in between the measurements shown in a. The IrMn (111) texture develops during those hours. (c) False color magnetic Kerr image after switching twice the magnetization of the FM layer during the crystallization of the AFM one. The different colored areas distinguish the exchange-coupled regions and their direction (green and blue) and the areas with free FM (yellow areas).
Tecnological and biomedical applications of magnetic nanoparticles

GROUP LEADER

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TECHNICIAN

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Research Lines

The scientific interest of the NANOMAGBIOTECH group mainly relies on exploiting physical phenomena of magnetic nanoparticles -activated by optical irradiation and alternating magnetic fields- for energy and biomedical applications. Moreover, the development of novel instrumentation or methodologies for probing new evidences are key issues in our research activities.

Our current research lines focus on:

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

2. The study of the influence of biological matrices and fluids on the AC magnetic response of magnetic nanoparticles. We are highly interested on understanding the effects of cell processing on the intracellular magnetic response of magnetic nanoparticles in order to find solutions for its preservation.

3. The use of magnetic nanoparticles as magnetic transducer for sensing molecular markers in biological fluids. We have developed a novel methodology for detection of biomolecules dispersed in blood based on variation of AC hysteresis loops of magnetic nanoparticles after interacting with the targeted biomolecule.

4. Heating losses of iron oxide nanoparticles activated by optical means. We are interested on probing the parameters that influence the heat loses of magnetic nanoparticles subjected to laser irradiation.

5. The development and validation of instrumentation for advanced magnetic measurements. In the last 5 years, the Advanced Instrumentation Unit has developed high-tech instrumentation for reliable characterization of magnetic nanoparticles in colloidal dispersions or inside biological matrices.

Magnetic nanoparticles exposed to alternating magnetic fields have shown a great potential acting as magnetic hyperthermia mediators for cancer treatment. However, a dramatic and unexplained reduction of the nanoparticle magnetic heating efficiency has been evidenced when nanoparticles are located inside cells or tissues. We studied the effect of cell internalization on the dynamical magnetic response of iron oxide nanoparticles (IONP). Two methodologies have been employed for experimentally determining the magnetic heat losses of magnetic nanoparticles inside live cells without risking their viability, as well as the suitability of magnetic nanostructures for in vitro hyperthermia studies. Our experimental results -supported by theoretical calculations- reveal that the enhancement of intracellular IONP clustering mainly drives the cell internalization effects rather than intracellular IONP immobilization. Understanding the effects related to the nanoparticle transit into live cells on their magnetic response will allow to design of nanostructures containing magnetic nanoparticles whose dynamical magnetic response will remain invariable in any biological environments, allowing sustained and predictable in vivo heating efficiency. See: D. Cabrera et al. ACS Nano 12, 2741(2018).
Spinorbitronics

GROUP LEADER

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Group webpage:
http://nanociencia.imdea.org/spinorbitronics/group-home
Research Lines

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

The main research lines of the group are:


Graphene can be exploited for highly efficient, dense, fast and low-consumptive room temperature SpinOrbitronics devices. We have engineered epitaxial structures where an epitaxial ferromagnetic Co layer is sandwiched between an epitaxial Pt(111) buffer grown in turn onto insulating oxide substrates and a graphene layer. Gr not only provides suitable spin transport channels with long spin lifetime and propagation length, but also enhances the perpendicular magnetic anisotropy up to 4 nm thick Co films and allows chiral left-handed Néel-type domain walls stabilized by the effective Dzyaloshinskii–Moriya interaction (DMI) in the stack. See *Nano Lett.*, 2018, 18 (9), pp 5364–5372.
Epitaxial Growth

GROUP LEADER

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POSTDOC

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PhD STUDENT

Juan Carlos Martin

Research Lines

The Molecular Beam Epitaxy (MBE) group has different interests in the field of Surface Science: Spectroscopy, Microscopy, chemical reactivity, growth and magnetism of thin films. The MBE laboratory has several Ultra High Vacuum (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. We pay special attention to the use of synchrotron radiation techniques to study magnetic properties of different materials, being users of different synchrotron radiation facilities around the world.

Group webpage:
http://www.imdeanociencia.org/research/research-programs?view=article&id=330:nanomagnetism
In particular we carry out projects in:

**Surface reactivity:** We investigate the role of different surfaces in the synthesis of organic molecules in prebiotic chemistry, as well as polymerization processes on metallic and oxide surfaces (“Reactivity of a FeS Surface under Room Temperature Exposure to Nitrogen and H2S” *Journal of Physical Chemistry C* (2018), 122 pp. 24129-24136). As well we are interested in catalytic processes, like water splitting and OER reaction at FeNi oxide surfaces.

**Chirality:** We study the interplay between the chirality and spin filtering effects of thin molecular films, with the aim to develop new magnetic materials for organic spin valves and sensors (“Enantiosensitive non-ding of chiral molecules on a magnetic substrate investigated by means of electron spectroscopies” *Chimia* (2018), 72 pp. 418-243).

**Magnetism:** As part of the Nanomagnetism program we are interested in magnetic effects of metallic and organic thin films, in particular studying the influence of the magnetic anisotropy on properties of interest for device applications (“Magnetic ordering in an Fe0.2Cr0.8)1.5 [Cr(CN)6] Prussian blue analogue studied with synchrotron radiation based spectroscopies” *Journal of Materials Chemistry C* (2018), 6 pp. 8171-8186).

**Growth of molecular films:** We study the improvement of surfaces and interfaces of thin films of organic materials for solar cell (“Combinatorial optimization of evaporated bilayer small molecule organic solar cells through orthogonal thickness gradients” *Organic electronics* (2018), 59 pp. 288-292).
Growth & Nanostructuring

GROUP LEADER

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PhD STUDENTS

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Research Lines

Our group has interests in three main research lines:

1. **Micro/Nano Fabrication and Ultra-Precision Manufacturing for Applications in Magnetic Hard Disk Storage, Magnetic Random Access Memory (MRAM) and Magneto-Optical Sensors**: Lithography methodologies including Electron beam, EUV Interference, Nanoimprinting and Two photon Polymerization 3D imprinting for Magnetic Recording Patterning such as “Nanoscale perpendicular magnetic island arrays fabricated by extreme ultraviolet interference lithography”, Appl. Phys. Lett., 92 (10), 102505 (2008); “Template-directed self-assembled magnetic nanostructures for probe recording”, Appl. Phys. Lett., 95, 023116 (2009); Sub-20 nm STT-MRAM key technologies for patterning and etching process.


Rare-Earth free Permanent Magnets

GROUP LEADER

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TECHNICIANS

Noelia Lopez
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Research Lines

Our group is working on fundamental and applied aspects of permanent magnets (PMs) systems with no or reduced content of critical raw elements (rare-earths): MnAl-based, MnBi, L10-FeNi, ferrites, hybrid ferrite/NdFeB. The main research lines are:


Group webpage:
http://nanociencia.imdea.org/division-permanent-magnets-applications
3. Advanced 3D-printing of PMs. We are working together with companies to overcome the nowadays geometrical restrictions for developing high-performance PM devices. PM/polymer flexible filament has been produced for 3D-printing technologies with no deterioration of magnetic properties (*IEEE Trans. Magn.* 2018, 55 (2), 2101004).

4. Recycling of PMs. Our group works on correlating the microstructure and magnetic properties for enabling the reuse of PM waste as a high quality magnetic material (*ACS Sustainable Chem. Eng.* 2017, 5, 3243).

**Industrial collaborations**

1. Industrial projects “GAMMA” and “ECNanoManga”: we are working closely together with the company Höganäs AB (Sweden), which recently signed an agreement for full sponsorship of a PhD student for developing MnAl(C) as a PM alternative.

2. Innovation Fund (“Cheque Innovación”) by Regional Government of Madrid: we are applying advanced 3D-printing of composite materials (metal/polymer) to the fabrication of functional components developed by the SME RAMEM S.A. (Madrid).

3. The company IMA S.L. (Barcelona) and our group collaborate to gain knowledge in the fabrication of plastic magnets based on ferrites and NdFeB and in the interactions of hybrid ferrite/NdFeB bonded magnets.

4. We have initiated a collaboration with Urban Mining (private US-based company) towards the possible application of PM material recycled from HDDs in novel 3D-printing technologies.

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**Development of polymer/permanent magnet composite and magnetic filament.** Gas-atomized MnAlC particles in combination with a polymeric matrix have been used for the fabrication of a rare earth-free permanent magnet (PM) composite and an extruded filament with a continuous length exceeding 10 meters. Solution casting technique has been used for the preparation of the composite. The precursor consisted of a polyethylene (PE) matrix embedding quasi-spherical particles of the ferromagnetic t-MnAlC phase. A maximum filling factor of 86.5% has been obtained. The magnetic measurements reveal no deterioration of the properties of the MnAlC particles. The produced MnAlC/PE materials can be used as precursors for polymerized cold-compacted magnets and 3D-printing technologies in view of functional applications (from MEMs devices to energy and transport related applications). This work has resulted from the collaboration with the company Höganäs AB (Sweden), and it constitutes the first report on successful preparation of both permanent magnet MnAl-based composite and filament. See: *Sci. Technol. Adv. Mater.* 2018, 19, 465

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**Highlight**

Gas atomization

Magnetic response of starting powder, composite and filament

Solution casting

No degradation of magnetic properties of the particles.
Electrodeposited nanowires

GROUP LEADER

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Group webpage:
http://nanociencia.imdea.org/electrodeposited-nanowires/group-home
Research Lines

We have interests in three main research lines, mainly focused on the study of the fundamental properties and applications of electrodeposited nanowires.

**Domain wall spintronics.** We study the domain wall structure and the magnetization processes of low dimensional systems – mainly cylindrical nanowires. We are interested in stabilizing domain walls in artificially created defects (Sci. Rep. 8 (2018) 16695) and in controlling the depinning of the different domain walls, induced by magnetic fields and by spin-polarized currents. Understanding the dynamics of the domain walls in individual nanowires as well as the global magnetization dynamics in arrays of nanowires would allow us to incorporate these nanostructures in spintronics devices. Part of this research is carried out in synchrotron radiation facilities (Nanoscale 10 (2018) 5566).

**Transport properties of Bi-based materials.** Bi-based metallic nanowires provide an attractive scenario for fundamental investigation of finite-size effects due to the unusual electronic structure of Bi and the large spin-orbit coupling of Bi atoms. We have already synthesized single-crystal Bi nanowires and reported weak antilocalization effects in the magnetotransport properties (Appl. Phys. Lett. 96 (2010) 082110). Now, we focus our interest on the synthesis of Bi-doped metallic nanowires. This system is expected to show large spin mixing conductance, as we have already reported in thin films (APL Materials 6 (2018) 101107).

**Nanowires for applications.** We prepare nanowires in solution for different applications, from chemical sensors (RSC Adv. 5 (2015) 97503-97507) to biomedical applications (J. Phys. Chem. C. 121 (2017) 23158-23165). We are also developing arrays of metallic nanowires that can be used as active part of nanostructured electrodes in neural interfaces.

The precise control and stabilization of magnetic domain walls is key for the development of the next generation magnetic nanodevices. Using XMCD-PEEM, we have observed a topologically protected magnetic domain wall in a ferromagnetic cylindrical nanowire. Its structure is stabilized by periodic sharp alterations of the chemical composition in the nanowire. The large stability of this topologically protected domain wall contrasts with the mobility of other non-protected and non-chiral states also present in the same nanowire. These results are relevant for the design of future spintronic devices such as domain wall based RF oscillators or magnetic memories.

programme

Nanomedicine

Programme Manager: Prof. Rodolfo Miranda

Research lines

**Neural Interfaces**
Mª Teresa González

**Metallodrugs**
Dr. Ana Pizarro

**Hyperthermia**
Dr. Daniel Ortega

**Nucleic Acids and Nanoparticles in Nanomedicine**
Prof. Álvaro Somoza

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

**Engineering Biofunctional Nanostructures**
Dr. Aitziber L. Cortajarena

**Magnetic Nanoparticles in Biomedicine. Cell-particle Interactions**
Prof. Ángeles Villanueva
About the programme

The Nanomedicine Programme is focused on the development of novel nanotechnologies for medical applications that will result in better, more efficient, and cost-effective therapeutic and diagnostic tools. One of the important areas is the preparation and use of magnetic nanoparticles (MNPs) in medicine, in particular for cancer treatment and diagnosis. MNPs selectively target tumours for multimodal treatment as drug nanocarriers and heating inductors. This research is highly interdisciplinary, combining the range of expertise necessary to successfully develop this research from the nanoparticle synthesis to the pre-clinical applications. In search of efficiency in the fight against cancer, another area within Nanomedicine is addressing the need to reduce toxic side effects associated with cancer therapies using different strategies, (i) self-immolative linkers that attach drugs to nanoparticles and release a drug once in target cells and (ii) design of new pH-sensitive chemotherapeutic agents that can be activated by the tumor micro-environment. The development and utilisation of nanotechnology can further the search for new cancer therapies and this knowledge will impact across this multidisciplinary community.

The generation of sensors based on nanoparticles for detection of targets of medical interest is a research area that aims to exploit the higher sensitivity and specificity of nanostructure-based diagnostics platforms. Researchers at IMDEA Nanociencia are developing distinct diagnostic tools able to detect biological targets. One example is the use of nucleic acid conjugated gold nanoparticles to detect different biomarkers involved in diseases such as uveal melanoma, pancreatic cancer and Duchenne muscular dystrophy. Another area of interest is the use of nanotechnology-based solutions to the growing problem of antibiotic-resistant bacteria. Nanostructures and nanoparticles with antibacterial properties that rely on different antibacterial mechanisms are being investigated as promising alternatives to antibiotics. Selective bacterial entrapping nanotextures are also under development as bacteria sensor platforms.
Neural Interfaces

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Research Lines

We fabricate and characterize nanostructured devices to be used as neural interfaces of enhanced performance respect to classic neural electrodes. We follow two parallel lines:

1. Electrical electrodes covered by vertical conducting nanowires for electrical stimulation of the neural activity.
   - Using the technique of template-assisted electrochemical deposition, we explore different materials to prepare conductive electrodes covered by vertical metallic nanowires.
   - We fabricate our own aluminium oxide nanotemplates by anodization, in order to explore different geometries, densities and distributions of the nanowires in the array.
   - Using IMDEA-Nanociencia clean room facilities, we pattern electrode heads by optical lithography. In this way, we prepare ready-to-use electrodes for biocompatibility and performance tests.

2. Sensors of neural activity base on magnetoresistive materials. We aim to demonstrate that magnetoresistive materials can be used to sense the neural activity without the use of cryogenic liquids (as SQUIDs detectors need).
   - Starting from the LSMO thin films grown over vicinal substrates by our colleagues at CNRS-GREYC, we pattern devices to be used as neural sensors which do not need to be in intimate contact with the neural tissue, and work at room temperature.
   - In order to explore the in-bench performance of the sensors, we measure two main figures of merit of the devices: the sensitivity, meaning how much the resistance of the sensor varies per unit of applied magnetic field, and its accuracy by performing power spectral density measurements.
   - A portable home-made magnetically isolated chamber is used for a first characterization of the sensors. In addition, we explore Wheatstone-bridge configurations together with strategic shielding layers.

The magnetoresistance (MR) effect is widely used in technologies that pervade the world, from magnetic reading heads to sensors. Diverse contributions to MR, such as anisotropic, giant, tunnel, colossal, and spin-Hall, are revealed in materials depending on the specific system and measuring configuration. Half-metallic manganites hold promise for spintronic applications but the complexity of competing interactions has not permitted the understanding and control of their magnetotransport properties to enable the realization of their technological potential. This study reports on the ability to induce a dominant switchable magnetoresistance in $\text{La}_0.7 \text{Sr}_0.3 \text{MnO}_3$ epitaxial films at room temperature (RT). By engineering an extrinsic magnetic anisotropy, a large enhancement of anisotropic magnetoresistance (AMR) is achieved which at RT leads to signal changes much larger than the other contributions such as the colossal magnetoresistance. The dominant extrinsic AMR exhibits large variation in the resistance in low field region, showing high sensitivity to applied low magnetic fields. These findings have a strong impact on the real applications of manganite-based devices for the high-resolution low field magnetic sensors or spintronics. See: Adv. Funct. Mater. 2017, 1700664
Metallo drugs

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Research Lines

We exploit metal coordination and organometallic chemistry principles to design novel potent switchable metallodrugs, which allow us to modulate the cancerous cell machinery at the molecular level in a controlled manner.

Our research seeks to exploit the physico-chemical features of the tumour cell, resulting from its distinct metabolism, for controlled drug activation (pro-drug approach) and cancer versus normal cell selectivity.

In a working frame of basic research, our main goal is to produce new activatable metallo-organic drug candidates that can exert amplified chemical reactivity, for example through catalysis, inside human cancer cells. We hypothesize that our metallodrugs’ effect will compromise the cell redox and pH homeostasis and ultimately limit cancer progression and stop invasion. A fundamental aspect of our research is to describe the chemical interactions of our systems with the intracellular components at the nanoscale.

Finally, we benefit from recent developments in nanomedicine to load our metallodrugs to a number of nano-systems which provide a variety of advantages, such as target cell accumulation or hyperthermia.

We have unveiled the intricate and attractive aqueous behaviour of RuII-arene complexes with a tethered carboxylate. Opening and closure of the tether ring is totally reversible and can be controlled by pH, being highly dependent on the chelating bidentate ligand XY. The lability of the RuII–O_tether bond also affects the catalytic activity of these complexes regarding transfer hydrogenation reactions. We relate such reactivity to the effect of these complexes in cancer cells. See: *Inorganic Chemistry* 2018, 57, 5657-5668.
Hyperthermia

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Irene Rubia

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Research Lines

Following are our two main research lines:

- Computational electromagnetism for in silico testing. Starting from animal and human computable phantoms, we perform computer simulations of therapies and diagnostic techniques based on the interaction of electromagnetic fields and magnetic and optical nanomaterials in the frequency range of kHz. Our mission is to provide clinicians with powerful tools to choose the best therapeutical conditions by predicting body response. The group collaborates closely with hospitals and medical devices manufacturers within the remit of the European project NoCanTher focused on treating pancreatic cancer through magnetic hyperthermia, and is involved in the preparation of the clinical studies. We also aim to a wider validation of in silico temperature predictions with dedicated experimental measurements at the nanoscale in the NANOLOCO project.

- Design of multifunctional magnetic nanomaterials. We design and synthesise a wide range of magnetic nanomaterials applied to biomedicine; for example, magnetic hyperthermia (MH), brain imaging contrasts, and magnetic particle imaging (MPI) tracers. Within this research line, the combination of magnetic hyperthermia and MPI is our current priority. These lines are embodied in the international collaborative networks we participate/coordinate: MyWAVE, RADIOMAG, NanoBioAp, NANO.

In silico testing – biology experiments fully done by means of computer simulations - is currently part of the discovery and pre-clinical phases of drugs and medical devices. Using custom made mice melanoma phantoms, we predicted the thermal relaxation of tissues after in vivo nanoparticle-mediated hyperthermia treatments and proposed it as a means for diagnosing tumors faster - in 6 days after tumour implantation - than the current ocular inspection standard, which takes 11 days for a reliable detection (Advanced Functional Materials, 28 (2018) 1803924). Currently we are conducting extended tests with human phantoms to translate it in near-future trials.
Nucleic Acids and Nanoparticles in Nanomedicine

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Research Lines

Our group is interested in novel approaches for the treatment and detection of diseases, particularly:

1. **Nanocarriers of bioactive molecules**, such as nucleic acids or drugs, that improve their delivery and reduce their toxicity. In this regard, we aim to develop smart nanoparticles that can release their cargo at the target cells. *Nanoscale* 2014, 6, 7436–42; *Breast Cancer Res.* 2015, 17, 1–17.

2. **Sensors of nucleic acids based on nanomaterials**, such as gold nanoparticles, that can provide sensitive and affordable sensors for the detection of genetic diseases. We are developing systems based on nucleic acids and gold nanoparticles that aggregate in the presence of the target sequence. *Anal. Bioanal. Chem.* 2019, 411 (9), 1807–1824; *Chem. Commun.* 2014, 50, 3018.

3. **CRISPR-based gene editing systems** that can repair mutations involved in diseases. This powerful technology can be used to introduce indels efficiently. However, the precise control of the mutations edited is more complicated, and modified oligonucleotides might be required. *Angew. Chemie Int. Ed.* 2016, 55, 3548–3550.

Uveal melanoma (UM) is the most common primary intraocular malignant tumor in adults and around half of the patients develop metastasis and die shortly after because of the lack of effective therapies for metastatic UM. Consequently, new therapeutic approaches to this disease are needed. In this regard, we have developed a therapeutic system based on gold nanoparticles modified with microRNAs mimics and SN38. Particularly, four microRNAs downregulated in UM have been chosen to reprogram cancer cells, to promote cell death or increase their sensitivity to the chemotherapeutic SN38. Remarkably, our approach presents a synergistic effect. *Biomimetics* 2018, 3 (4), 28.
Engineering Biofunctional Nanostructures

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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 (Sci Reports 2016 doi: 10.1038/srep35786; ChemNanoMat 2017 doi: 10.1002/cnma.201600333; Nanoscale 2017 doi: 10.1039/c7nr04475e).

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. (Nanoscale 2014 doi: 10.1039/c4nr01210k, Biomacromolecules 2015 doi: 10.1021/acsbiomac5b01147; ACS Applied Mat Interfaces 2017).

A key challenge in the treatment of cancer with nanomedicine is to engineer and select nanoparticle formulations that lead to the desired selectivity between tumorigenic and non-tumorigenic cells. To this aim, novel designed nanomaterials, deep biochemical understanding of the mechanisms of interaction between nanomaterials and cells, and computational models are emerging as very useful tools to guide the design of efficient and selective nanotherapies. This works shows, using a combination of detailed experimental approaches and simulations, that the specific targeting of cancer cells in comparison to non-tumorigenic cells can be achieved through the custom design of multivalent nanoparticles.

Nanooncology

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Magnetic Nanoparticles In Biomedicine. Cell-Particle Interactions

GROUP LEADER

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Research Lines

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

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Programme Manager: Prof. J.L. Carrascosa

Research lines

- Nanobiosystems
  - Prof. J.L. Carrascosa

- Advanced Fluorescence Nanoscopy
  - Dr. Cristina Flors

- Protein Engineering
  - Dr. Begoña Sot

- Molecular Motors Manipulation Lab
  - Dr. Borja Ibarra

- Mechanical properties of Biostructures
  - Dr. Johann Mertens

- Protein Biophysics
  - Prof. Victor Muñoz
About the programme

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

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Research Lines

Our group is working in different aspects of technological developments in microscopy, as well as in applications of the use of viral systems for nanotechnological applications.


The use of viral-related particles for development of vehicles for transfer of materials is an interesting area of research where we have worked on the characterization of assembly of viral cages (Elena Pascual, Carlos P Mata, José L Carrascosa and José R Castón. Assembly/disassembly of a complex icosahedral virus to incorporate heterologous nucleic acids. Journal of Physics: Condensed Matter, 29 (49) doi: 10.1088/1361-648X/aa96ec (2017)), and in the study of incorporation of specific protein determinants to viral particles (Carlos P. Mata, Daniel Luque, Josué Gómez-Blanco, Javier M. Rodríguez, José M. González, Nobuhiro Suzuki, Said A. Ghabrial, José L. Carrascosa, Benes L. Trus, José R. Castón. Acquisition of functions on the outer capsid surface during evolution of double-stranded RNA fungal viruses PLOS Pathogens, 8, doi.org/10.1371/journal. ppat.1006755 (2017)).

We have also worked in synthetic biological approaches for the use of viral components to produce vesicles capable to transfer specific DNAs (Moleiro, L.H., Mell, M., Bocanegra, R., López-Montero, I., Fouquet, P., Hellweg, T., Carrascosa, J.L., Monroy, F. Permeability modes in fluctuating lipid membranes with DNA-translocating pores. Advances in Colloid and Interface Science, 247, 543-554 (2017)), and in the development of new vaccination platforms against cancer (Lorea Villanueva, Leyre Silva, Diana Llopiz, Marta Ruiz, Tamara Iglesias, Teresa Lozano, Noelia Casares, Sandra Hervas-Stubbbs, María José Rodríguez, José L. Carrascosa, Juan José Lasarte & Pablo Sarobe. The Toll like receptor 4 ligand cold-inducible RNA-binding protein as vaccination platform against cancer. Journal Oncoimmunology, e1409321, doi.org/10.1080/2162402X.2017.1409321 (2017)).

Superparamagnetic iron oxide nanoparticles (SPION) have become important tools in nano-biotechnology and nano-biomedicine. These new developments require a precise quantitative analysis at sufficient spatial resolution to model the interactions between nanoparticles and the cellular structures in a quantitative way. To tackle this issue 15 nm dimercaptosuccinic acid functionalized SPION were incubated with MCF-7 breast cancer cells as a model system to be analyzed exploiting the iron differential absorption contrast at the L3 iron edge. Near-edge absorption soft X-ray nanotomography (NEASXT) combines whole-cell 3D structure determination at 50 nm resolution, with 3D elemental distribution and quantification and high throughput. We have solved the three-dimensional distribution and quantification of SPIONs within the cells with sufficient sensitivity to detect the density corresponding to a single nanoparticle in the whole cellular volume (Fig. 1).
Advanced Fluorescence Nanoscopy

GROUP LEADER

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Group webpage: http://imdeananotools.wix.com/flors
We develop novel methods, typically based on light, to study biology and biomaterials at the nanoscale. Our main research lines are:

- **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. In our group, 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). We are using this setup to study a range of nano/biomaterials, for example amyloid-like protein fibers (*Nanoscale* 2016, **8**, 9648; *Small* 2017, **13**, 1603784).

- **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; *Chem. Commun*. 2016, **52**, 8405; *ChemPhotoChem* 2018, **2**, 571).
Protein Engineering

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Research Lines

Our group is mainly focussed in the modification of proteins by protein engineering for their use in nanomedicine and nanotechnology.

Specifically, the current research topics are:

1. The design of new strategies for an efficient editing of Pancreatic cancer cells based on Cas proteins. CRISPR/Cas system is a promising tool for gene editing, able to treat most genetic diseases. But the efficient delivery of Cas proteins is a bottle neck of this strategy. In this project we modify these proteins (cas9 and cpf1) to conjugate them to nanostructures able to deliver them efficiently to specific tissues.

2. Combinatorial therapy for pancreatic cancer treatment, based on nanovehicles loaded with Cas13 and Gemcitabine. Cas13 are newly discovered CRISPR proteins able to cut RNA, and therefore they can block specifically the expression of proteins inside cells. We plan to load nanovehicles with drugs and Cas13 proteins designed to avoid the synthesis of proteins responsible for Pancreatic Cancer cells chemoresistance. Our hypothesis is that cancer cells treated with these nanovehicles will be sensitive to the delivered drug, being then a new approach to treat Pancreatic Cancer.

3. Antibacterial activity of inorganic nanoparticles conjugated with modified bactericidal peptides. The bacterial antibiotic resistance makes essential the design of new bactericides.

Rasal is a modular multi-domain protein whose expression inhibition promotes k-Ras over-activation and cancer. To date, it has not been crystallized, and their size is not adequate for nuclear magnetic resonance (NMR) or for high-resolution cryo-electron microscopy (cryoEM). Here we present the low resolution structure of full-length Rasal, obtained by single-particle negative staining electron microscopy, which allows us to propose a model of its domain topology. These results help to understand the role of the different domains in controlling Rasal activity. See *Biof Chem.* 2017,399, 63. doi: 10.1515/hsz-2017-0159.
Molecular Motors Nanomanipulation Lab

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Research Lines

The design of synthetic molecular motors is one of the most exciting challenges facing nanotechnology. The major inspiration behind designing artificial motors is to mimic the precision of biological motors. Our laboratory uses nanoscale techniques to analyze and manipulate the activity of biological and synthetic molecular motors one molecule at a time. This possibility provides unprecedented insight into the dynamics and mechano-chemical mechanisms that govern their operation at the molecular level. The main research lines of our laboratory include the study of:

1. **Biological machinery involved in nucleic acids metabolism.** Replication and transcription of DNA are fundamental for life. We are measuring the operational dynamics of the biological machinery involved in: i) mitochondrial DNA replication *(NAR 2017; PLoS One 2017; JSAT 2016)* and ii) transcription of Influenza A viral genome.

2. **Membrane nanomechanics.** The cell membrane maintains the integrity of the cell. We have recently developed a method to measure the dynamics of motor proteins involved in remodeling of cell membranes. *(BioRxiv 472829, 2018).*

3. **Synthetic molecular motors:** We have developed new methods to measure the mechanical strength of non-covalent interactions *(Chem. Science 2017)* and the dynamics and mechanistic principles of operation of individual synthetic molecular switches. *(Nature Comms 2018).*

4. **Technology development.** 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.
Protein Biophysics

GROUP LEADER

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Research Lines

Our group focuses on the biophysical study of protein folding mechanisms with special emphasis on the ultrafast folding regime (Biochem J. 2016), including our pioneering work on the downhill and one-state scenarios. We use a divide-and-conquer strategy in which we extract mechanism-structure relationships by investigating a catalogue of 16 fold archetypes (Curr. Op. Struc. Biol. 2016). We investigate the folding behavior of such archetypes at the structural dynamic, thermodynamic, kinetic and single-molecule stochastic levels using kinetics, single-molecule fluorescence and single-molecule force spectroscopy, NMR, in conjunction with theoretical modeling and computer simulations. In addition, we have continued developing improved methods for investigating folding, such as microsecond-resolution single-molecule fluorescence (J Phys Chem B. 2015), analysis of protein folding at atomic resolution (JACS 2015), and the reversible mechanical (un)folding of fast folding proteins (Nat Com, 2016).

A second research focus targets the roles of folding mechanisms in protein function with an emphasis in conformational rheostats, a novel allosteric mechanism that exploits the conformational heterogeneity of downhill folding modules to produce analogical signals at the conformational heterogeneity of downhill folding modules to produce analogical signals at the single-molecule level (in contrast to the binary response of allosteric switches). Here we are pursuing four main avenues: 1) development of protein-based biosensors based on downhill folding modules; 2) investigating the role of conformational rheostats in coordinating protein-protein interaction networks (Phys Chem Chem Phys, 2017), and; 3) in the homing mechanism that transcription factors use to efficiently search for and bind to their target DNA sequence (Phys. Chem. Chem. Phys., 2017); 4) engineering of controllable symmetric macromolecular complexes from monomeric globular proteins using the principle of partial unfolding coupled to assembly.

EnHD along DNA: Engrailed homeodomain, Drosophila transcription factor, specifically binding to its target sites on DNA in order to perform its biological function. The multiple binding modes existing in the DNA searching process have been addressed by coarse-grained molecular simulations. The dynamic picture facilitates the DNA co-localization as well as specific DNA binding (function-on) and releasing (function-off) process during EnHD-DNA recognition.
programme

Nanofabrication

Research lines

Functional Surfaces
Prof. Isabel Rodríguez

Quantum Devices
and Photonics
Dr. Daniel Granados

Transport in 2D Systems
Prof. Jose Luis Vicent

2D Materials
Dr. David Perez de Lara
2. Research programmes and scientists

imdea nanoscience institute
Functional Surfaces

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Research Lines


2. Multifunctional surfaces. The program is developing the methodology to impart onto polymer nanocomposites additional surface properties, particularly those of super-hydrophobicity and self-cleaning based on bio-inspired surface nanotexturing (Sci. Rep. 2017, 7, 43450). The program is also focused on up-scaling the methodology using Roll to roll nanoimprint technology.

3. Polymer nanoimprinting for optical applications such as polymer lasers and waveguides, antireflective surfaces (Nanoscale, 2018, 10, 15496) and optical sensors in collaboration with the Organic Photophysics and Photonics group.

We have produced nanoimprinted moth-eye surface nanocomposite films exhibiting multifunctional broadband anti-reflective and photo-induced self-cleaning properties with improved mechanical resistance.

The anti-reflective films are produced in combined processing steps of titanium dioxide nanoparticle coating and surface imprinting of moth-eye nanostructures. Nanoparticle - polymer blending and formation of reinforced sub-wavelength surface nanocomposite features is achieved simultaneously.

This methodology represents a practical approach for producing nanoimprinted surfaces with superior mechanical properties and multi-functionality. The films are suitable for flexible and portable solar devices (Navarro et al., Nanoscale, 2018, 10, 15496).
Quantum Devices and Photonics

GROUP LEADER

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Research Lines

The information society is experiencing a global challenge, with the amount of information to be stored, transmitted or processed growing continuously every year. Quantum technologies are expected to become crucial to address this challenge, with the second quantum revolution blasting off. The Quantum nano-Devices Group (QnDG) was created in 2015 with the purpose of contributing to this revolution. It focuses on micro and nanofabrication of electronic and photonic hybrid devices for quantum information technologies. A solid-state approach is fostered towards the realization of single photon emitters (SPEs), cavity quantum electrodynamics (CQED), single photon detectors (SPDs), random number generators (RNDs) and physically unclonable functions (PUFs).

The Quantum Nano Devices Group also collaborates tightly with the Centre of Astrobiology (CAB-INTA-CSIC) in the development of Kinetic Inductance Superconducting Detectors (KIDs) for space exploration. KIDs are expected to become the next generation technologies for the forthcoming missions in the GHz to THz bands. Recently (2018) we have also started working together on the development of superconducting devices for quantum technologies.

Exploring novel patterning routes to tailor the properties of 2D materials such as Graphene or Transition Metal Dichalcogenides (TMDCs). While many groups have
focused on the study and exploitation of the intrinsic properties of 2D materials, very limited work has been devoted to the engineering of their intrinsic properties. The “all-surface” nature of these materials makes device fabrication complex, and so far only the most conventional micro and nanofabrication or tailoring routes have been explored.

Between 2014 and 2018, a very large effort was done for the development of high-quality CVD graphene field effect transistor devices (GFETs). A method to dope N-type or P-type the GFETs with non-covalent molecular functionalization was demonstrated. Encapsulation of the devices later via Atomic Layer Deposition makes the doping unalterable over time and under different ambient conditions. Results were published recently: “Encapsulating Chemically Doped Graphene via Atomic Layer Deposition”. ACS Applied Materials & Interfaces, 10, (2018) 8190-8196. Also, we have demonstrated the scalable production of hybrid devices based on heterostructures of graphene and colloidal semiconductor encapsulated quantum dots. Results on the production of the devices were published recently: “Large-Area Heterostructures from Graphene and Encapsulated Colloidal Quantum Dots via the Langmuir–Blodgett Method.” ACS Applied Materials & Interfaces, 10, (2018) 6805-6809. A third publication is nearly ready for submission on the optical response of these heterostructures.

Micro and Nanofabrication of Kinetic Inductance Detectors for Space exploration. As a result of the collaboration between IMDEA-Nano and CAB-INTA-CSIC, we have produced together with the first broadband sub-micron demonstrator of a lumped element kinetic Inductance detector. We used Aluminium as a superconductor and produced a working array of 8 pixels consisting of lines with 15 nm thickness and 200 nm linewidth; with a meander length over 10 millimetres. The results were published in “Development of sub-micron broadband lens-coupled LEKIDs for sub-mm astronomy”, Journal of Low-Temperature Physics, 16 (2016).

Also, our first 4-inch working demonstrator based on Al, with 1024 pixels was recently produced, working in the dual band at 850 and 380 GHz. This is our contribution to advancing the TRL of the technology and several demonstrators have already been sent to France to test them in field-breadboard conditions (TRL5-TRL6).

In 2018 a new method has been developed to control the doping of graphene field effect transistor devices, and make this doping changes permanent. Controlling graphene’s doping will be critically important for its incorporation into future electronic and optoelectronic devices. We present a simple method for achieving long-term p- and n-doping of graphene devices through vapor phase evaporation of organic molecules, followed by encapsulation under an inert Al₂O₃ film. This film, grown via an optimized atomic layer deposition process, ensures long-term doping stability, as confirmed by electrical transport and Raman spectroscopy measurements. The doping is maintained even after storing the devices for six weeks in ambient conditions. The results have been published in ACS Applied Materials and Interfaces (DOI: 10.1021/acsami.7b18709).
Transport in 2D Systems

GROUP LEADER

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Researcher ID: 7006735519

ASSOCIATE RESEARCHERS

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VISITING RESEARCHER

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Universidad Complutense de Madrid, Spain

PhD STUDENTS

Victor Rollano
Marina Calero
(co-supervised with Dr. Granados)

Dr. Alicia Gomez
PhD: Universidad Complutense de Madrid
Double Affiliation: CSIC-INTA, Torrejon de Ardoz

Group webpage:
http://www.imdeananociencia.org/home-en/people/item/jose-luis-vicent-lopez
Research Lines

Our group has been working last year in three main research lines:

1. **Nanostructured superconductors:** We have studied different topics related to the behavior and properties of superconductors at the nanoscale. In brief: a) Superconducting ratchet effect induced by topologically protected magnetic Néel walls in Co honeycomb nanostructures; b) The interplay between two type II superconductors when the highest Tc superconductor is patterned in a nano-array embedded in a film of the lowest Tc superconductor.

2. **Magnetic nanostructures:** We have studied two different scenarios: a) Synthetic nanomagnets, based on Co/Pd multilayers and Py films which combine in-plane and out-of-plane magnetic anisotropies in the same sample; b) Arrays of Fe single crystal nanomagnets which magnetocrystalline axes can be tailored.

In superconducting/magnetic hybrids such that the nanomagnet systems show strong or weak stray magnetic fields, relevant magnetic features can be probed by superconducting vortices. The hybrids consist on triangular nanomagnets arrays embedded in superconducting thin films. The most noteworthy outcomes are: i) vortices can detect the stray magnetic field direction; ii) vortices can distinguish between magnetically ordered or disordered array of nanomagnets; iii) vortices moving on nanomagnets with weak stray field can discriminate the sizes of magnetic domains as small as 70 nm; iv) Finally, the effect on the vortex motion of the periodic roughness of the sample is masked by the distribution of stray fields in the nanomagnet array. (Sci. Rep. 8, 12374, 2018).

Left: Magnetoresistance of sample Nb film/[Co/Pd] multilayer triangles as-grown state. Center: Magnetoresistance of sample Nb film/[Co/Pd] multilayer triangles remanent state. Right: MFM image of Co/Pd triangles: (a) as grown; (b) at remanence after out-of-plane saturation.
2D Materials

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

PhD: Istituto di Cibernetica del CNR, Italy / Universidad Autonoma de Madrid
Previous Positions: Universidad Complutense de Madrid, Spain.
Istituto di Cibernetica del CNR, Italy. ESTEC, European Space Agency, The Netherlands

Orcid:
0000-0002-9839-3409

POSTDOCS

Riccardo Frisenda
TU Delft, The Netherlands

PhD STUDENTS
Patricia Gant
Yansheng Liu

Group webpage:
http://www.imdeanociencia.org/2d-materials-devices/group-home
Research Lines

1. Isolation and characterization of novel and unexplored 2D materials. We mechanically exfoliate and investigate 2D materials (see *Nanotechnology* 28 455703 (2017)) and novel layered materials as naturally occurring van de Waals heterostructures like franckeite (see Beilstein Journal of Nanotechnology (2017), 8, 2357-2362, doi:10.3762/bjnano.8.235). We developed a differential reflectance and transmittance spectroscopy setup with a lateral resolution of ~1 μm in the visible and near-infrared part of the spectrum to determine the number of layers of 2D materials and characterize the fundamental optical properties, such as excitonic resonances (see *Journal of Physics D: Applied Physics* 50(7) 074002 (2017)).

2. Optoelectronic devices based on 2Ds: we study the physical properties of photodetectors, photodiodes and solar cells based on atomically thin materials. We have fabricated and characterized 2D materials based devices like hybrid stacks between 2D materials and other functional materials with different dimensionality (see 2D Materials 4, (2017) 034002, (DOI:10.1088/2053-1583/aa797b) or purely 2D devices like vertical homojunctions made by stacking few-layer flakes of MoS2 (Journal of Materials Chemistry C 5(4) 854-861 (2017)).

3. Strain engineering: we are very interested in tailoring the optical and electronic properties of 2D materials by means of mechanical deformations. Strain engineering provides a powerful route to modify the electrical and optical properties in 2D materials and thus it is an excellent candidate to be used as an external tuning knob. (see *NPJ 2D Materials and Applications* 1, 10 (2017) DOI:10.1038/s41699-017-0013-7).

Designer heterostructures can now be assembled layer-by-layer with unmatched precision thanks to the recently developed deterministic placement methods to transfer two-dimensional (2D) materials. This possibility constitutes the birth of a very active research field on the so-called van der Waals heterostructures. Moreover, these deterministic placement methods also open the door to fabricate complex devices, which would be otherwise very difficult to achieve by conventional bottom-up nanofabrication approaches, and to fabricate fully-encapsulated devices with exquisite electronic properties. The integration of 2D materials with existing technologies such as photonic and superconducting waveguides and fiber optics is another exciting possibility. Here, we review the state-of-the-art of the deterministic placement methods, describing and comparing the different alternative methods available in the literature, and we illustrate their potential to fabricate van der Waals heterostructures, to integrate 2D materials into complex devices and to fabricate artificial bilayer structures where the layers present a user-defined rotational twisting angle (*Chem. Soc. Rev.*, 2018, 47, 53).
Services

RMN and Mass Spec. Services

Dr. Zulay Pardo
PhD: Universidad Complutense de Madrid, Spain

Dr. Rebeca Bocanegra
PhD: Universidad Autónoma de Madrid, Spain

Optical Tweezers

Dr. Sara de Lorenzo
PhD: Universidad de Barcelona, Spain

Dr. Santiago Casado
PhD: Universidad de Cantabria, Spain

AFM Service

Cell Cultures

Dr. Adriana Arnaiz
PhD: Cambridge University, UK

Dr. Vanessa Rodríguez
PhD: Universidad Autónoma de Madrid, Spain

Workshop

Mr. Warren Smith
Technician

Ms. Fabiola Mogollon
Assistant

Nanofabrication Services

Dr. Manuel Rodríguez
PhD: Universidad de Santiago de Compostela, Spain

Dr. Maria Acebrón
PhD: Universidad Autónoma de Madrid, Spain

Mr. Andrés Valera
Technician

Ms. Andrea Martin
Assistant

Cryogenics

Ivan Redondo
Technician
Management

Mr. Bonifacio Vega
General Manager

Ms. Isabel Rodríguez
MS in Administration, Administration and Finance Manager

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

Dr. José Luis Casillas Villa
Facilities & Infrastructure General Manager

Dr. Mark William Davies
Industrial Liaison Manager

Dr. Elena Alonso
Project Assistant

Mr. Ignacio Torres
Projects Assistant

Ms. Mireia Gracia
Projects Manager

Mr. Pablo Gómez
NANOFRONTMAGNET Project Assistant

Ms. Paloma Macua
Administrative Assistant

Ms. Elena Pérez
Administrative Assistant

Ms. Juana Hemoso
Administrative Project Assistant

Ms. Paloma Castillo
Director’s Assistant

Ms. Margarita Gil
A3/ER System Technician

Mr. Óscar Bodas
Network and Systems Manager
1. Publications, contributions to books and patents [129]
2. International Congresses [148]
3. Workshops & courses (co)-organized by IMDEA Nanociencia [167]
4. Seminars [169]
5. Projects [172]
6. Fellowships and Internships [178]
7. Academic Activities [180]
8. Honours [186]
9. Outreach Activities [188]
10. In the media [193]
11. Social Networking [196]
1. Publications, contributions to books and patents

1.1. Publications


48. Robust organic radical molecular junctions using acetylene terminated groups for C-Au bond formation (2018) *Journal of the American Chemical Society, 140* (5), pp. 1691-1696. DOI: 10.1021/jacs.7b10019


119. **Attosecond coupled electron and nuclear dynamics in dissociative ionization of H2.** Cattaneo, L., Vos, J., Bello, R.Y., Palacios, A., Heuser, S.,...


Delgado, R., Martín, N. (2018) *Journal of the American Chemical Society*, 140 (31), pp. 9891-9898. DOI: 10.1021/jacs.8b03847


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nanoscience and nanotechnology: small is different


Writing, proofreading and editing in information theory. Arias-Gonzalez, J.R. *Entropy* 2018, 20 (5), 368. DOI: 10.3390/e20050368


1.2. Contributions to books


### 1.3. Patents

<table>
<thead>
<tr>
<th>Title</th>
<th>Publication Number</th>
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<td>Ferrite type materials and process for the production thereof</td>
<td>WO2018211121 (A1)</td>
<td>2018-11-22</td>
<td>Real Alberto Bollero [ES], Delleda Stefano [NO], Camarero De Diego Julio [ES], Guzik Matylda [NO], Rodríguez Javier Rial [ES]</td>
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<td>Polymeric composites with functional surfaces</td>
<td>Wo2017167909 (A1)</td>
<td>2017-10-05</td>
<td>Hernández Rueda Jaime [ES], Hernández Rueda Jaime [ES], Rodríguez Fernández Isabel [ES], Navarro Baena Iván [ES], Viela Bovio Felipe [ES]</td>
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<td>Modified solid support for the synthesis of oligonucleotides</td>
<td>US2016075680 (A1)</td>
<td>2016-03-17</td>
<td>Somoza Calatrava Álvaro [ES], Latorre Lozano Alfonso [ES]</td>
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<td>Detection and treatment of gnaq mutant uveal melanoma cells with gold nanoparticles</td>
<td>WO2015116502 (A1)</td>
<td>2015-08-06</td>
<td>Urda Susana Ortiz [Us], Somoza Calatrava Álvaro [ES], Latorre Lozano Alfonso [ES], Posch Christian [Us]</td>
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<td>Production of corrugated and porous graphene from cdf for the use thereof as supercapacitors</td>
<td>ES2538604 (A1); ES2538604 (B1)</td>
<td>2015-06-22</td>
<td>Coronado Miralles Eugenio [ES], Ribera Hermano Antonio Luis [ES], Abellan Saez Gonzalo [ES], Zamora Abanades Félix [ES], Mas Ballesté Rubén [ES], Rodríguez San Miguel David [ES]</td>
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<td>Functionalised magnetic nanoparticle</td>
<td>WO2016150521 (A1)</td>
<td>2016-09-29</td>
<td>López Cortajarena Artióber [ES], Somoza Calatrava Álvaro [ES], Couleaud Pierre [ES], Ocampo García Sandra [ES], Aires Trapote Antonio [ES], Latorre Lozano Alfonso [ES]</td>
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<td>Functionalized metal nanoparticles and uses thereof for detecting nucleic acids</td>
<td>EP3099814 (A1)</td>
<td>2016-12-07</td>
<td>Somoza Calatrava Álvaro [ES], Latorre Lozano Alfonso [ES], Ortiz Urda Susana [Us], Posch Christian [Us]</td>
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<td>Method for the synthesis of covalent organic frameworks</td>
<td>WO2015015035 (A1)</td>
<td>2015-02-05</td>
<td>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]</td>
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<td>Graphene dried powder and method for its preparation</td>
<td>WO2015014662 (A1)</td>
<td>2015-02-05</td>
<td>Miranda Soriano Radoño [ES], Zamora Abanades Félix Juan [ES], Mas-Ballesté Rubén [ES], Asani Mohammad-Reza [ES], Carcelén Valero Verónica [ES], Castellano Dolzaré Manuel [ES]</td>
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<td>Position-sensitive photodetector, method for obtaining same and method for measuring the response from the photodetector</td>
<td>ES2384766 (A1); ES2384766 (B1)</td>
<td>2012-07-12</td>
<td>Cabanillas Gonzalez Juan [ES], Campoy Quiles Mariano [ES]</td>
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<td>Position-sensitive photodetector, method for obtaining same and method for measuring the response from the photodetector</td>
<td>EP2650939 (A1)</td>
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<td>Cabanillas Gonzalez Juan [ES], Campoy Quiles Mariano [ES]</td>
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<td>20111207</td>
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In numbers...

Publications

- Nº of publications: 1,700
- Sum of the times cited: 38,139
- Average citation per item: 22,43
- h index: 86

2018

- Nº of publications: 200
- Average impact factor: 8,20
- Q1 publications: >75%
- D1 publications: >30%
highly cited researchers
2. International Congresses

2.1. Invited lectures

17/01/2018
2nd Frontiers of Organic Semiconductor Lasers, South China University of Technology, Guangzhou, China
The Effect of Host Exciton Confinement on Polymer Blend Lasing
J. Cabanillas-Gonzalez

17/01/2018
Residencia del Embajador Británico, Madrid, Spain
Informe de la producción científica de la colaboración entre España y Reino Unido
R. Miranda

23/01/2018
Fundación BBVA, Madrid, Spain
Acto de comunicación del fallo del jurado de los Premios FUNDACIÓN BBVA Fronteras del conocimiento y la cultura - Ciencias Básicas
R. Miranda

02/02/2018
Sino-Hispanic Meeting on Functional Conjugated Organic Materials for (Opto)Electronics & Thermoelectrics. IMDEA Nanociencia, Madrid, Spain
Welcome
R. Miranda
Exploring New Avenues in the Chemical Modification of Nanomaterials
E. M. Pérez
Highly-Efficient Perovskite Solar Cells from Sulfur-rich Hole-Transporting Materials
N. Martín

06-07/02/2018
Winter College on Extreme Non-linear Optics, Attosecond Science and High-field Physics. International Center for Theoretical Physics (ICTP), Trieste, Italy
Theoretical modeling of attosecond dynamics in molecules
F. Martín

08/02/2018
European Commission, Brussels, Belgium
First year meeting ByAxon
R. Miranda

11-16/02/2018
XXI Symposium on Atomic, Cluster and Surface Physics (SASP 2018). Obergutgl, Austria
The unusual stability of charged, endohedral and exohedral fullerenes
F. Martín

11-16/02/2018
XVII Escuela Nacional de Materiales Moleculares, Torremolinos, Spain
Molecular Machines, Mechanically Interlocked Molecules and Carbon Nanotubes
E. M. Pérez
Fullerenos y Grafenos: Curvatura vs Planaridad en Nanoformas de Carbono
N. Martín

22-23/02/2018
IMDEA Nanociencia (MIRANDA FEST), Madrid, Spain
Nanostructures for Biomedical Applications
Á. Somoza
Spin-orbit driven effects in graphene based systems
P. Perna
From surface science to nanotechnology a forty years journey, Miranda fest
R. Miranda
Lanthanides at surfaces
D. Ecija

08/03/2018
NIL Industrial day 2018, Viena, Austria
Safe by design bactericidal surfaces via nanoimprinting of surface nanocomposites
I. Rodríguez
08/03/2018
Hotel The Westin Palace, Madrid, Spain
45ª Aniversario de las relaciones diplomáticas entre China y España
R. Miranda

13-15/03/2018
Bilbao Exhibition Centre (BEC), Bilbao, Spain
NanoSpain2018 International Conference within Imaginenano2018
R. Miranda

18-23/03/2018
255th ACS National Meeting. James Flack Norris Award Symposium in honor of Cindy Burrows, New Orleans, USA
Synthetic Chiral Carbon Nanoforms
N. Martín

10/04/2018
Reunión SP2 (grupo español de investigación en materiales bidimensionales), Madrid, Spain
F. Guinea

23-27/04/2018
InterMag 2018, Singapore
In silico testing of clinical magnetic hyperthermia: progresses and future directions
I. Rubia-Rodríguez, H. Verdaguer, T. Macarulla and D. Ortega
Sustainability in the production of Sr-ferrite magnets: understanding microstructure-magnetic correlation translates to a successful recycling case in industry
A. Bollero; J. Rial; M. Villanueva; A. Seoane; J. Almunia; R. Altimira

25/04/2018
German-Spanish Symposium on Functional Hybrid Nanomaterials, Universidad de Valencia, Valencia, Spain
Hybrid nanoscopy of hybrid nanomaterials
C. Flors

05/05/2018
XII Encuentro Nacional de Docentes de Química
La tercera forma alotrópica del carbono y Sir Harry W. Kroto
N. Martín

13-17/05/2018
233rd Electrochemical Society (ECS) Meeting, Seattle, USA
Antiviral Activity of Self-Assembled Glycodendr0,0[60]Fullerene onadducts
Synthetic Chiral Carbon Nanoforms
Complexation and Electronic Communication of Corannulene-Based Buckybowls and a Curved Electron Donor
N. Martín

14-16/05/2018
Lectures at the Frontiers of Condensed Matter Physics, Taipei, Taiwan
F. Guinea

15/05/2018
Half-A-Topo Day. Institut Néel, Grenoble, France
Anomalous thermal transport in Weyl semimetals
Y. Ferreirós

20-25/05/2018
11th European School on Molecular Nanoscience (ESMolNa 2018), Tenerife, Spain
Synthetic Chiral Carbon Nanoforms
N. Martín

21-22/05/2018
International Symposium. Superconductivity and Pressure: A Fruitful Relationship, Madrid, Spain
Superconducting vortices on the move. A powerful tool to study nanomagnetism: from magnetic superlattices to spin-ices
J. L. Vicent
Switching the Kondo effect on TCNQ through a catalytic reaction in CH2CN functionalized graphene on Ru(0001)
30-31/05/2018
Workshop on High Performance Computing for Next Generation of Nanomaterial and Nanodevices Engineering, Barcelona, Spain
Attosecond electron and nuclear dynamics in molecules
F. Martin

02/06/2018
Simposio “Bridging European Science II”, Embajada Española en Berlín, Germany
Presentación de COSCE y Mesa Redonda
N. Martín

03-07/06/2018
17th International Conference on Electroanalysis, Rhodes, Greece
Bioelectrocatalytic activity of individual biomolecule and gold nanoparticle distribution detected by nanoscale
E. Lorenzo

06-08/06/2018
VI San Luis Conference on Surfaces, Interfaces and Catalysis, Santa Fe, Argentina
La Nanotecnología es una especie de tsunami
R. Miranda

07-08/06/2018
1st Spanish Conference on Biomedical Applications of Nanomaterials (SBAN2018), Madrid, Spain
Doped nano-ferrites for cancer therapy and diagnosis
G. Salas
Unconventional Chemistry of Nanomaterials
E. M. Pérez

12/06/2018
2nd International NanoFrontMag Workshop, Madrid, Spain
Spin Orbit driven effects in Graphene-FM systems and in half-metallic oxides
P. Perna

18/06/2018
16th International Congress of Quantum Chemistry (ICQC). 18-23/06/2018, Menton, France
Attosecond pump-probe spectroscopy of aminoacids
F. Martin

18-22/06/2018
14th International Conference on Organic Electronics, University of Bordeaux, France
Efficient Hole Transporting Materials for Perovskite Solar Cells
N. Martín

18-22/06/2018
E-MRS Spring Meeting 2018, Strasbourg, France
Polymerization of rare earth-free permanent magnet particles for advanced 3D printing technology
E. M. Palmero; J. Rial; J. de V.; A. Bollero
Quantum electronic behavior at organic/metal interfaces
R. Otero

20-21/06/2018
ICFO. Workshop on the interaction of light with quantum and topological materials, Barcelona, Spain
Polariton Hall effect in transition metal dichalcogenides
L. Chirolli

20-22/06/2018
XXVII Reunión Bienal de Química Orgánica de la RSEQ, Santiago de Compostela, Spain
Teaching young dogs newer tricks: unconventional chemistry of nanomaterials.
E. M. Pérez

24-29/06/18
Novel 2D Materials Explored Via Scanning Probe Microscopy & Spectroscopy, San Sebastián, Spain
Polariton Hall effect in transition metal dichalcogenides
L. Chirolli

27/06/2018
Jornadas Jóvenes Investigadores 2018. Instituto de Cerámica y Vidrio (ICV-CSIC), Madrid, Spain
Magnetic and photothermal nanoparticle-based therapies: thermal cancer treatments and intracellular transformations
A. Espinosa
01/07/2018
4th International Conference Current trends in Cancer Theragnostics, Trakai, Lithuania
Advanced tumor detection and diagnosis by in vivo thermal transient nanothermometry

04/07/2018
1st meeting on Inorganic and Hybrid Materials for Sensing, symposium at the Annual Meeting of the Portuguese Chemistry Society, Porto, Portugal
Chemical Sensing Schemes Combining Fluorescence and Amplified Spontaneous Emission of Conjugated Systems
J. Cabanillas-Gonzalez

04/07/2018
Reunión Nacional de Óptica 2018, Castellón, Spain
Attochemistry: imaging and controlling electron dynamics in molecules with attosecond light pulses
F. Martin

04/07/2018
Physical Chemistry Colloquium, Ludwig-Maximilians Universität München, Munich, Germany
Multivalent Glycofullerenes for Ebola Virus Infection
N. Martín

05-07/2018
CFF-2018 - Chemistry for the Future, Pisa, Italy
Towards Controlled Light Emission in Organic Solids
J. Gierschner

06/07/2018
International conference on excited state processes, Santa Fe, USA
Maximizing performance in all-small molecule solar cells with non-fullerene acceptors (Invited)
L. Lüer

12-13/07/2018
1st nanoBIOSOMA Symposium on Design, Development & Production of Nanocarriers & Nanovehicles, Madrid, Spain
Magnetic Nanoparticles as Nanobiodevices
G. Salas

15-20/07/2018
Quantum Designer Physics, San Sebastián, Spain
Orbital magnetic response of class DIII topological superconductor
Luca Chirolli

16/07/2018
AM30 Symposium Dresden 2018, Dresden, Germany
Band-like charge transport in a semiconducting 2D metal organic framework
E. Cánovas

16-17/07/2018
Synthetic Chiral Carbon Nanoforms
N. Martín

19/07/2018
60th Birthday Science Symposium for Hans-Joachim Egelhaaf, Nürnberg, Germany
There and Back Again: a 20 Years Journey on the Photophysics of Distyrylbenzenes
J. Gierschner

21-24/08/2018
International Conference on Many Particle Spectroscopy of Atoms, Molecules, Clusters and Surfaces (MPS 2018), Budapest, Hungary
Attosecond coupled electron and nuclear dynamics in molecules
F. Martin

21-25/08/2018
Spanish node of Centre Européen de Calcul Atomique et Moléculaire (Z-CAM), Zaragoza, Spain
Molecular ionization and attosecond molecular movies
F. Martin

26-30/08/2018
7th EuCheMS Chemistry Congress, Liverpool, UK
Attochemistry: imaging and controlling electron dynamics in molecules
F. Martin
26-30/08/2018
Rare Earth Permanent Magnets and Advanced Magnetic Materials and Their Applications (REPM 2018), Beijing, China
Rapid-milling applied to isotropic rare earth-free permanent magnet powders: from ferrites to MoAl
A. Bollero; J. Rial; E. M. Palmero; J. Camarero; P. Švec; P. Švec Sr.

03-09/08/2018
2nd International Workshop on Magnetic Materials and Nanomaterials MMN2018, Boumerdes, Algeria
Magnetic nanoparticle-mediated thermal therapies: quantitative comparison of heat generation, therapeutic efficiency and limitations
A. Espinosa

03-07/09/2018
JEMS 2018 - Joint European Magnetic Symposia, Mainz, Germany
Multifunctional magnetic nanoparticle based-approaches for cancer treatment: therapy and biodegradation
A. Espinosa

04/09/2018
10th International Meeting on Photodynamics and Related Aspects (IMPSA 2018), 3-7/09/2018, Cartagena de Indias, Colombia
Attochemistry: imaging and controlling electron dynamics in molecules
F. Martin

05/09/2018
Flatlands beyond graphene 2018, Leipzig, Germany
Band-like charge transport in a semiconducting 2D metal organic framework
E. Cánovas

05-07/09/2018
N. Martín

06/09/2018
Casa de Brasil, Madrid, Spain
Celebración del Día de la Independencia de Brasil
R. Miranda

18/09/2018
FLEET ARC Centre of Excellence in Future Low-Energy Electronics Technologies, Melbourne, Australia
Graphene as playground for molecules: from physisorption to catalysis
A.L. Vázquez de Parga

20/09/2018
2nd International Workshop on Cosmic Fullerenes (19-21/09/2018), Orsay, France
The unusual stability of charged, endohedral and exohedral fullerenes
F. Martin

20-21/09/2018
IMDEA Nanociencia, Madrid, Spain
NoCanTher General Assembly
R. Miranda

20/09/2018
12th RES Users’ Conference, Valencia, Spain
Understanding the modifications of the physical properties of supported graphene by means of Density Functional Theory
M. Pisarra

25-28/09/2018
Taishan Forum for Advanced Interdisciplinary Research 2018 (Taishan FAIR 2018), Jinan, China
Micro/Nano Fabrication and Ultra-Precision Manufacturing for Magnetic Random Access Memory (MRAM) and Its Applications in Brain-machine Interfaces and Artificial Neural Networks
F. Luo

26/09/2018
Workshop on Rare-Earth mining and environmental impact in Castilla-La Mancha, Escuela Técnica Superior de Ingenieros Agrónomos (UCLM), Ciudad Real, Spain
Current research efforts to replace and recycle rare-earth elements
A. Bollero

26/09/2018
Embajada de China, Madrid, Spain
69º Aniversario de la República Popular China
R. Miranda
01-07/10/2018
EXTMOS Summer School, Erice, Italy
*Organic Solid State Emitters by Design*
J. Gierschner

03-05/10/2018
III Congreso Nacional de Jóvenes Químicos y Bioquímicos Terapéuticos (III QUIMBIOQUIM), UCLM, Albacete, Spain
*Bolas de azúcar de fullerenos contra el virus del Ébola*
N. Martín

07-12/10/2018
Worshop on vortex behavior in unconventional superconductors, Braga, Portugal
*Topologically protected superconducting ratchet effect generated by spin-ice magnets*
V. Rollano

09/10/2018
International Workshop Series IMDEA Nanociencia: Nanoscale Imaging and Manipulation in Life and Materials Science, Madrid, Spain
*Novel correlative microscopy tools to study biology and biomaterials at the nanoscale*
C. Flors

17-20/10/2018
TTN-2018 International Conference: Tunneling Through Nanoscience, Ravello, Italy
*Mapping the spin distribution in adsorbed molecules*
R. Miranda
*Superconducting Vortex Dynamics on Spin Ice Nanomagnets.*
J. L. Vicent

18/10/2018
Universidad Jaume I, Castellón, Spain
*Láseres de attosegundos: la cámara superlenta de la física, la química y... la biología?*
F. Martín

19/10/2018
Madrid UCM Student Chapter – ECS. I Edition of the Research Contest BRAIN WARS, the future in your hands
*Welcome talk*
N. Martín

22/10/2018
European XFEL, Hamburg, Germany
*Imaging and controlling electron dynamics in molecules and solids*
F. Martín

22-26/10/2018
nanoGe Fall Meeting, Torremolinos, Spain
*Band-like charge transport in a semiconducting 2D metal organic framework*
E. Cánovas
*Efficient hot electron transfer at quantum dot-oxide interfaces*
E. Cánovas
*From Liquid-Phase Exfoliated 2D Materials to Functioning Devices*
E. M. Pérez

01/11/2018
University of Electro-Communications, Tokyo, Japan
*Whither nanomedicine in Europe? A sneak preview*
D. Ortega and I. Rubia-Rodríguez

05/11/2018
Fundació La Caixa, Barcelona, Spain
*Ceremonia de entrega de Becas y ayudas en Investigación e Innovación de la Fundación La Caixa*
R. Miranda

07/11/2018
Ministerio de Ciencia, Innovación y Universidades, Madrid, Spain
*Simposio Hispano-Japonés de Investigación Médica*
R. Miranda

08-09/11/2018
2018 Barluenga Lectureship, Universidad de Oviedo, Oviedo, Spain
*Synthetic Chiral Carbon Nanoforms*
N. Martín

22/11/2018
IV Congreso Internacional Salud y Empleo Público, Almería, Spain
*Nanotecnología o el arte de la ciencia ficción convertida en realidad*
R. Miranda
23-24/11/2018
pi-System Figuration, Japan-Spain Symposium, IMDEA-Nanoscience, Madrid, Spain
2D, 1D, 0D, unusual strategies to interface nanomaterials and molecules
E. M. Pérez
On surface chemistry
D. Écija
Synthetic Chiral Carbon Nanoforms
N. Martín

26-28/11/2018
IWSENT 2018. International Workshop on Sound-enabled Nanotechnologies, Valencia, Spain
Strain-induced phenomena in graphene and other 2D materials
Francisco Guinea

07/12/2018
Journée Thématique Couplage Microscopies Optiques -Microscopie à Force Atomique, Université Aix-Marseille, Marseille, France
Combining AFM with super-resolution fluorescence microscopy: some results and many challenges
C. Flors

10-14/12/2018
4th International Conference on Two-Dimensional Materials and Technologies, Melbourne, Australia
Invited Oral
Graphene as playground for molecules: from chemisorption to catalysis
A.L. Vázquez de Parga

18/12/2018
NN18-Nanoscience & Nanotechnology, at Laboratori Nazionali di Frascati, Frascati, Italy
Graphene on SiO2 under ultrahigh pressure
M. Pisarra

2.2. Regular contributions

18-19/01/2018
9th Symposium on Computing pi-Conjugated Compounds, Naples, Italy
Oral Contribution
Scientist’s Responsibility in Postfactual Times
J. Gierschner

21-26/01/2018
42th International Conference and Expo on Advanced Ceramics and Composites, Miami, USA
Oral Contribution
Composite nanostructures as a means for bioimaging, nanothermometry, photothermal therapy and controlled magnetic heating

24/01/2018
X GEFES meeting (Grupo Especializado de Física del Estado Sólido, Valencia, Spain
Oral Contribution
Organic building blocks for single-molecule spintronics
E. Burzuri

28/01-02/02/2018
European Winter School in Physical Organic Chemistry (e-WISPOC 2018)
Oral Contribution
Multivalent Glycofullerenes for Ebola Virus Infection
N. Martín
A current story in Chemistry: the carbon nanoforms and Sir Harry W. Kroto
N. Martín

29/01/2018
SUSTAIN — Third Annual Meeting, Tromso, Norway
Oral Contribution
Effects of species interactions in population synchrony scales: competition and predator-prey interactions
J. Jarillo Diaz
3. Scientific report

01/02/2018
62th Annual Meeting Biophysical Society, San Francisco, USA
Poster Contribution

DNA synthesis determines the binding mode of the human mitochondrial single-stranded DNA-binding protein.
Cerrón F, Jarillo J, Cielsiesky G, Kaguni LS, Cao FJ, Ibarra, B.

02/02/2018
Sino-Hispanic Bilateral Meeting on Functional Conjugated Organic Materials for (Opto)Electronics & Thermoelectrics, Madrid, Spain
Oral Contribution

Organic Optoelectronics Research at IMDEA Nanoscience
J. Gierschner

XVII Escuela Nacional Materiales Moleculares, Torremolinos, Spain
Oral Contribution

Phthalocyanines and Molecular Materials
T. Torres

05/02/2018
IV Chemical Biology Group Meeting (4GEB), Barcelona, Spain
Poster Contributions

Advanced Therapies Based on Nanoparticles: efficient drug delivery and CRISPR/Cas9 gene editing
A. Latorre, A. Latorre, A. Lázaro, M. Calero, A. Crespo, M. Lecea, J. Lombardía, P. Martín-Duque, Á. Villanueva, and Á. Somoza

Uveal Melanoma Treatment Based on Gold Nanoparticles: Oligonucleotide Therapy Combined with Chemotherapy
P. Milán Rois, E. G. Garrido, A. Latorre, A. Latorre, Á. del Moral, M. Lecea, Á. Somoza

11/02/2018
Symposium on Advanced Functional Materials, Université de Bretagne Occidentale (UBO), Brest, France
Oral Contribution

Molecular Materials based on Phthalocyanines
T. Torres

22/02/2018
International Workshop Series IMDEA Nanociencia: From surface science to nanotechnology, Madrid, Spain
Key note

Spin-orbit driven effects in graphene based systems
P. Perna, J. Camarero, & R. Miranda

01/03/2018
International Conference of Synthetic Metals, Chamonix, France
Oral Contribution

Five minutes in the life of a molecular shuttle
Naranjo T, Lemishko KM, de Lorenzo S, Ritort F, Pérez E, Ibarra, B.

05-09/03/2018
Annual Meeting American Physical Society, Los Angeles, USA
Oral Contribution

Superconducting Vortex Motion on Magnetic Potentials Made with Arrays of Spin-Ice Nanomagnets

06-07/03/2018
2nd International Workshop Computational and Theoretical Nanoscience, Madrid, Spain
Oral Contribution

Frontiers in Chemistry of Molecular Materials
R. Miranda

2nd International Workshop on Frontiers in Chemistry of Molecular Materials, Madrid, Spain
Oral Contributions

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

Towards Controlled Light Emission in Organic Solids
J. Gierschner

Glycofullerenes: extremely efficient multivalent systems for Ebola virus infection
N. Martin
12/03/2018
2018 Joint Conference of the EPS and DPG Condensed Matter Divisions, Berlin, Germany

Oral Contributions

Enhanced PMA and DMI at Room Temperature in epitaxial graphene-based structures grown onto oxides
P. Perna

Tuning domain wall velocity with Dzyaloshinskii-Moriya interaction in epitaxial asymmetric trilayers
F. Ajejas, P. Perna

12-14/03/2018
COST TO-BE SPRING MEETING 2018 - Towards oxide-based Electronics, San feliu de Guixols, Spain

Poster Contributions

A novel route to control magnetic anisotropy in La0.67Sr0.33MnO3 thin films
SK Chaluvadi, F Ajejas, P Orgiani, O Rousseau, G Vinai, A Y Petrov, P Torelli, J Camarero, P Perna, L Méchin

Dominant switchable magnetoresistance in half-metallic La0.7Sr0.3MnO3 epitaxial films at room temperature

27/03/2018
Physics of solar cells: from basics to nanoscience, Les Houches, France

Poster Contribution

Estimation of quantum effects influence on the performance of solar cells covered with metallic nanoparticles
K. Kluczyk, C. David, W. A. Jacak

07/04/2018
3rd International School of Nanomedicine: Nanofluidics, Nanoimaging and Nanomanipulation, Erice, Italy

Oral Contribution

Simultaneous AFM nanoindentation and fluorescence microscopy of soft materials and individual bacteria
A. del Valle, P. Bondia, C. Flors

09/04/2018
3rd International School of Nanomedicine: Nanofluidics, Nanoimaging and Nanomanipulation, Erice, Italy

Oral Contribution

Corelate AFM and fluorescence microscopy of amyloid fibers: structural characterization and light-induced damage
P. Bondia, A. del Valle, S. Casado, C. Flors

23-27/04/2018
InterMag 2018, Singapore

Oral Contributions

High coercive MnAl powders produced by rapid milling for permanent magnet applications
J. Rial; P. Švec; E.M. Palmero; J. Camarero; P. Švec Sr.; A. Bollero

In-situ Studies of the Dynamical Magnetic Response of Iron Oxide Nanoparticles in Cellular Environments
D. Cabrera, N.D. Telling, A. Coene, J. Leliaert, E.J. Artés-Ibáñez, L. Dupré, F.J. Teran

Ultra-thin films of L10-MnAl on GaAs (001): tuning the properties of the Mn-Ga-As-Al interphase
C. Navío; M. Villanueva; E. Céspedes; F. Mompeán; M. García-Hernández; J. Camarero; A. Bollero

24/04/2018
ICCC2018, Sendai, Japan

Oral Contribution

Novel strategies to obtain room temperature sensing molecular-based switchable materials
J.S. Costa

01/05/2018
12th International Conference on the Scientific and Clinical Applications of Magnetic Carriers, Copenhaguen, Denmark

Oral Contributions

Iron deficiencies and structural defects favor magnetic hyperthermia performance of magnetite nanocubes in viscous media
Taking advantages of nanomagnetism for detecting biomarkers dispersed in biological fluids

Poster Contributions
Influence of cell internalization on the dynamical magnetic response of iron oxide nanoparticles
D. Cabrera, A. Coene, J. Leliaert, E. J. Artés-Ibáñez, L. Dupré, N. D. Telling, and F. J. Teran

MagnoTher: A Fully Inorganic Drug-loaded Magnetic Hyperthermia Agent

01/05/2018
Gold2018, Paris, France

Oral Contributions
Gold films with subwavelength holes: Optical properties in the scope of nonlocal charge carriers
C. David, N. A. Mortensen, J. Christensen

14-17/05/2018
233rd Electrochemical Society Meeting, Seattle, USA

Oral Contributions
Noncovalent Chemistry of SWNTs Inside-Out
E. M. Pérez

Novel Strategies to Interface Molecules and 2D Materials
E. M. Pérez

Subphthalocyanines Axially Substituted with Electroactive Moieties
T. Torres

21-24/05/2018
4th European Workshop on Epitaxial Graphene and 2D Materials, Salamanca, Spain

Oral Contributions
h-BN on Cu(111): Geometric corrugation and intercalation of functional molecules

Evidence of large spin-orbit coupling effects in quasi-free-standing graphene on Pb/Ir(111)

Relativistic Dispersion of Massive Electrons in Graphene Nanoribbons
B. Cirera, J. M. Gallego, R. Miranda and D. Écija

21-22/05/2018
International Symposium. Superconductivity and Pressure: A Fruitful Relationship, Madrid, Spain

Poster Contributions
Controllable Switching of the Superconductivity of a Tungsten STM Tip on Epitaxial Graphene

Formation of a AuIr 2D alloy by intercalation of Au in graphene/Ir(111)
J. J. Navarro, F. Calleja, A. L. Vázquez de Parga and R. Miranda

22/05/2018
12th International Conference on the Scientific and Clinical Applications of Magnetic Carriers, Copenhagen, Denmark

Poster Contribution
In silico prediction of tissue damage and power deposition maps in human models for magnetic hyperthermia treatments
I. Rubia-Rodríguez, H. Verdaguer, T. Macarulla and D. Ortega

22-26/05/2018
12th International Conference on the Scientific and Clinical Applications of Magnetic Carriers, Copenhagen, Denmark

Poster Contribution
Synthesis of metal-oxide nanoparticles for biomedical applications
D. García, R. Amaro, L. Gutierrez, F. Herranz, G. Salas

29/05/2018
V Simposio de Jóvenes Investigadores IQFR, Madrid, Spain

Oral Contribution
Electrodos nanoestructurados para estimulación eléctrica neuronal
B. L. Rodilla, A. Arché, L. Pérez, A. Domínguez-Bajo, A. González-Mayorga, María Concepción Serrano, R. Miranda and M. T. González
03-07/06/2018
17th International Conference on Electroanalysis, Rhodes, Greece

Oral Contribution
Carbon nanodots based biosensors for gene mutation detection
T. García

Poster Contributions
Development of electrocatalytic platforms based on screen-printed electrodes mod with nanodiamonds
M. Revenga-Parra, F. Pariente, E. Lorenzo
One-step reducing and functionalizing graphene oxide. Application to Biosensing
I. Bravo, M. Revenga-Parra, F. Pariente, E. Lorenzo

07-08/06/2018
1st Spanish Conference on Biomedical Applications of Nanomaterials (SBAN2018), Madrid, Spain

Oral Contributions
Albumin-Based Nanostructures for Cancer Treatment
Nanostructured electrodes for neural electrical stimulation
B. L. Rodilla, A. Arché, L. Pérez, A. Domínguez-Bajo, Ankor González-Mayorga, María Concepción Serrano, R. Miranda, M. T. González

Poster Contributions
Cell internalization efficiency and cytotoxic effect of functionalized iron oxide magnetic nanoparticles (MNP)
V. Rodriguez-Fanjul; A.M. Pizarro
Exploring the synergy between metallodrugs and nanomaterials in nanomedicine
A. Arnáiz Vivas; A.M. Pizarro
Iridium(III) Anticancer Complexes for the Functionalization of Soft Nanoparticles
Osmium(II) and ruthenium(II) arene organometallic complexes with carboxylate groups for nanoparticle functionalization
S. Infante-Tadeo, F. Martínez-Peña, A. HabteM.m, and A.M. Pizarro

08/06/2018
9th International Meeting on Atomic and Molecular Physics and Chemistry (IMAMPC), Berlin, Germany

Oral Contribution
Surface analysis with molecular diffraction techniques: fast atomic and molecular diffraction from KCl(001) at grazing incidence conditions
M. del Cueto

13-14/06/2018
8th Early Stage Researchers Workshop (ESRW), IMDEA Nanociencia, Madrid, Spain

Oral Contributions
Divergent Sorption Behaviour of Isostructural Luminescent Lanthanide-based Metal-Organic Frameworks as Key for the Design of Novel, Selective and Sensitive Gas Sensors
A. Gamonal, J. S. Costa
Evaluation of antibacterial activity of magnetite/Ag nanocomposites with different silver content synthesized by an aqueous route
Y. Luengo, B. Sot, G. Salas
Nanoscale imaging of light-induced damage in amyloid fibers
P. Bondía, A. del Valle, B. Sot, Y. Sohma, M. Kanai, C. Flors
Nanostructured Graphene Catalyzes the Reaction between Two Organic Molecules
M. Pisarra
Nanowire interfaces as nanoelectrodes for neural electrical stimulation at the spinal cord
B.L. Rodilla, A. Arché, L. Pérez, A. Domínguez-Bajo, Ankor González-Mayorga, Maria Concepción Serrano, R. Miranda, M.T. González
Osmium(II) tethered complexes for shuttling protons into cancer cells
S. Infante-Tadeo
Reaction Products obtained in the Hydrothermal Synthesis of Carbon Dots
S. Ramírez, J. Sánchez, A. Jacobo, I. Navarro, I. Rodriguez, R. Wannenmacher
Synthesis and advanced 3D-printing of polymerized composites based on metallic particles
D. Casaleiz, E. M. Palermo; J. de V.; J. Hernández; S. López, E. Ramiro; A. Bollero
Towards Fabrication of MoS2 P-N Homojunctions via Pulsed Focused eBeam Induced Etching
F. J Urbanos
Poster Contribution

Moth-eye antireflective and self-cleaning surfaces with enhanced mechanical properties

In vitro study of the thermal stress mediated by iron oxide nanoparticles subjected to infrared irradiation and/or alternating magnetic fields
C. Lozano, A. Espinosa, B. Sot, and F.J. Teran

A neural bypass for sensing and stimulating at the spinal cord

A Robust and Unique Iron(II) Mosaic-like MOF Architecture
E. Fernandez-Bartolomé, J. S. Costa

Biomedical application of novel magnetic detection methodology based on AC magnetometry
L. Cremades, E. Sanz, N. Silvestri, T. Pellegrino, F.J. Teran and A.L. Cortajarena

Carbon Dots modified electrodes for catalysis of hydrazine
M. Mediavilla, M. Revenga-Parra, I. Bravo, F. Pariente, E. Lorenzo

Continuously Modulated Förster Resonant Energy Transfer between Organic Molecules by Electrical Doping of Graphene
Yansheng Liu, M. A. Niño, Feng Luo, R. Wannemacher

Electrically conducting coordination polymer as an acetonitrile chemical sensor
E. Resines-Urien, J. S. Costa

Functionalization of Magnetic Nanoparticles with Gemcitabine and Doxorubicin via disulfide bonds
N. Lafuente Gomez, M. Lecea, C. Rodriguez Diaz, Y. Luengo, G. Salas and A. Somoza

Functionalized gold nanoparticles for the detection of uveal melanoma miRNAs
C. Coutinho; C. Duarte; A. Latorre; Á. Somoza

Fundamentals of detection methodology based on the AC magnetization signal of functionalized magnetic nanoparticles in biological fluids
E. Sanz, L. Cremades, N. Silvestri, T. Pellegrino, F.J. Teran and A.L. Cortajarena

Interaction of L-Alanine and L-Dialanine with Aluminium Oxide surfaces
J. C. Martín, A. de la Escosura, O. Rodríguez de la Fuente, J. M. Rojo, M. A. Niño

Optimization of the resolution of pauses in biological motors
A. Tejedor

Organometallic iridium(III) cyclopentadienyl complexes bearing a structural strain as potential anticancer pro-drugs
A.C. Carrasco, V.Rodriguez-Fanjul and A.M. Pizarro

Protein Engineering for improved delivery in CRISPR-based gene deiting strategies
C. Escalona-Noguero; Rafael soler; B. Sot

Simultaneous AFM nanoindentation and fluorescence microscopy of soft materials and individual bacteria
A. del Valle, P. Bondia, C. Flors

Synthesis of ferrite nanoparticles for biomedical applications
D. Garcia-Soriano, R. Amaro, L. Gutiérrez, G Salas

Oral Contribution

Photosensitizers based on Phthalocyanines for Photodynamic Therapy
T. Torres

Low current modifications in anomalous Hall effect signals in perpendicularly magnetized system
A. Anadon, R. Guerrero, P. Perna

Sizeable Dzyaloshinskii-Moriya interaction at Graphene/Co interface
P. Perna

Tuning domain wall velocity with Dzyaloshinskii-Moriya interaction in epitaxial asymmetric trilayers
P. Perna

“Closing the loop” in magnet manufacturing: recycling of Sr-ferrite residues in a permanent magnet company
A. Bollero; J. Rial; M. Villanueva; A. Seoane; J. Almunia; R. Altamira

Metallicity by lanthanides of surface-confined multipyrroles
B. Cirera, J. M. Gallego, R. Otero, R. Miranda and D. Écija

Switching between molecular and plasmonic luminescence in electronically isolated fullerene nanocrystals
A. Martin. Jiménez; R. Miranda, R. Otero
20-22/06/2018
6th International Iberian Biophysical congress, Castellón, Spain

Poster Contributions

A single molecule manipulation assay to study the transcriptional dynamics of influenza A virus
Rodriguez-Pulido C, Bocanegra-Rojo R, Coloma R, Martin-Benito J, Ibarra B

Coordinated activity of the human mitochondrial DNA helicase (TWINKLE) with SSB proteins and the human mitochondrial DNA polymerase
Lemishko K, Cielsieski G, Kaguni LS, Ibarra B

Mechano-chemical characterization of membrane fission by dynamin

21/06/2018
International Conference of European materials Research Society (E-MRS), Strasbourg, France

Oral Contribution

Designing high performance all-small molecule solar cells with non-fullerene acceptors

24-25/06/2018
6th International Workshop on 2D Materials, Tenerife, Spain

Oral Contribution

Prespectives on Antimonene
F. Zamora

24-29/06/2018
Novel 2D Materials Explored Via Scanning Probe Microscopy & Spectroscopy, San Sebastián, Spain

Oral Contribution

Mapping the spin distribution in surface confined lanthanide derivatives by the Kondo effect
B. Cirera, J. M. Gallego, R. Miranda and D. Écija

Poster Contribution

Controllable Switching of the Superconductivity of a Tungsten STM Tip on Epitaxial Graphene

25-27/06/2018
3rd International Conference on Polyol Mediated Synthesis, Madrid, Spain

Oral Contribution

Hybrid nanomaterials based on metal oxides (Fe and Zn) for magnetically recoverable photocatalysts
L. González, L. Muñoz, G. Flores-Carrasco, M.E. Rabanal, G. Salas

27-29/06/2018
Fuerzas y Túnel, Jaca, Spain

Oral Contribution

Surface-assisted synthesis and functionalization of graphene nanostructures on Ag(111)
M. Garnica, Y. He, J. Ducke, A. Riss, C.A. Palma, F. Bischoff, D. Stradi, M-L. Bocquet, M. Batzill, W. Auwärter and J.V. Barth

Electronic and structural properties of CoO nanoislands on Au(111)

28/06/2018
Spotlight Polymat, San Sebastian, Spain

Oral Contribution

Simple Clues for Imine-based Organic Frameworks Processability
F. Zamora

01/07/2018
4th International Conference Current trends in Cancer Theragnostics, Trakai, Lithuania

Oral Contribution

Multifunctional Nanostructures for Nanothermometry, Photothermal and Magnetic Hyperthermia studies

01-06/07/2018
International Conference on Synthetic Metals (ICSM), Busan, South Korea

Oral Contribution

Amplified Spontaneous Emission in Insulated Polythiophenes”
Chen Sun
01-06/07/2018
10th International Conference on Porphyrins & Phthalocyanines, 10-ICPP, Munich, Germany
Repeat protein scaffolds: ordering photo- and electroactive molecules in solution and solid state
N. Martín

02-05/07/2018
XXXIX Reunion Grupo Electroquimica RSEQ, Madrid, Spain
Key note
Visualizing Biocatalytic Activity at a single Lox molecule using nanoscale SECM
E. Lorenzo
Oral Contribution
Carbon nanodots for Oxygen Reduction Reaction Electrocatalysis
I. Bravo

03/07/2018
10th International Conference on Porphyrins and Phthalocyanines (ICPP10), Munich, Germany
Oral Contribution
Molecular Materials based on Phthalocyanines: Following the pioneering path by Michael Hanack
T. Torres

04/07/2018
1st meeting on Inorganic and Hybrid Materials for Sensing, Symposium at the Annual Meeting of the Portuguese Chemistry Society, Porto, Portugal
Oral Contribution
High sensitivity and selectivity of mixed matrix membranes to NH3 among different amines through 2D mapping strategies
Ahmad Sousaraei

04-06/07/2018
XV Congreso Nacional de Materiales, Salamanca, Spain
Oral Contribution
Hybrid nanomaterials based on oxides (Fe and Zn) for magnetically recoverable photocatalysts
L. González, L. Muñoz, G. Flores-Carrasco, O. Milosévíc, G. Salas, M.E. Rabanal

07-11/07/2018
11th FENS Federation of European Neuroscience Societies, Berlin, Germany
Poster Contribution
Biological responses of neural cells and tissues to nanomaterials to interface the injured spinal cord
A. Domínguez, A. González-Mayorga, B. Rodilla, L. Pérez, M.T. González, E. López, M.C. Serrano

10/07/2018
27th IUPAC International Symposium on Photochemistry, Dublin, Ireland
Oral Contribution
Nanoscale imaging of amyloid photodynamic damage
P. Bondia, A. del Valle, B. Sot, Y. Sohma, M. Kanai, C. Flors

15-20/07/2018
21st ICM International Conference on Magnetism 2018, San Francisco, USA
Oral Contributions
Disentangling and quantifying temperature-driven symmetry-breaking effects in magnetic nanostructures with competing magnetic anisotropy contributions
J.L. Cuñado; R. Miranda; J. Camarero; P. Perna
Exchange bias setting driven by a spontaneous crystallization of the antiferromagnetic layer
A. Migliorini, B. Kuerbanjiang, D. Kepaptsoglou, M. Muñoz, J.L.F. Cuñado, J. Camarero, C. Aroca, G. Valléjo-Fernández, V. Lazarov and J.L. Prieto
From the lab to the factory: “Closing the Loop” through recycling by tuning microstructural and magnetic properties in Sr-Ferrite powder
A. Bollero; J. Rial; M. Villanueva; A. Seoane; J. Almunia; R. Altimira
Graphene-based synthetic ferrimagnets, antiferromagnets and exchange-biased ultrathin film structures
M. Valvidares, P. Gargian, L. Melo Costa, P. Perna, J. Camarero, R. Cuadrado, M. Pruneda, F. Sanchez
Graphene-ferromagnet structures with field-cool controllable perpendicular magnetization and coercivity asymmetries
M. Valvidares, P. Gargiani, L. Melo Costa, P. Perna, R. Miranda and J. Camarero
Interfacial coupling induced chiral symmetry-breaking of spin-orbit interaction in exchange biased systems
F. Ajejas; D. Maccariello; R. Guerrero; R. Miranda; J. Camarero; P. Perna.
Unravelling chiral Dzyaloshinskii-Moriya interaction at Graphene/FM interface

Poster Contributions

ByAxon: Towards an active bypass for neural reconnection

Control of the magnetization reversal processes in FeNi nanowires with chemical notches

Disentangling and quantifying temperature-driven symmetry-breaking effects in magnetic nanostructures with competing magnetic anisotropy contributions
J.F. Cuñado, P. Perna, A. Bollero, R. Miranda and J. Camarero

Dynamic and symmetry effects in magnetic nanostructures
J. Luis Cuñado; R. Miranda; J. Camarero; P. Perna.

Ferromagnetic manganese based ultra-thin films: structural, spectroscopic and magnetic characterization
C. Navío; M. Villanueva; E. Céspedes; F.J. Mompeán; M. García-Hernández; J. Camarero; A. Bollero

Low current modifications in anomalous Hall Effect signals in perpendicularly magnetized system
R. Guerrero; A. Anadon; A. Gudin; R. Miranda; J. Camarero; P. Perna

Magnetic polymerized composites for bonding and 3D-printing of alternative permanent magnets
E. M. Palmero; J. Rial; D. Casaleiz; J. de V.; A. Bollero

Nanoscale engineering of Large Anisotropic Magnetoresistance in La0.7Sr0.3MnO3 Films at Room Temperature
F. Ajejas; D. Maccariello; J. SantaM.; L. Méchin; R. Guerrero; R. Miranda; J. Camarero; P. Perna.

Control of the magnetization reversal processes in FeNi nanowires with chemical notches
S. Ruiz-Gomez, C. Fernández-González, M. Foerster, L. Aballe, R. Guerrero, J. de la Figuera, A. Quesada, A. Mascaraque y L. Perez

Severe variation of permanent magnet properties in gas-atomized MnAl particles by controlled nanostructuration and phase transformation
J. Rial; E. M. Palmero; J. Camarero; P. śvec; P. Śvec Sr.; A. Bollero

Tuning domain wall velocity with Dzyaloshinskii-Moriya interaction in epitaxial asymmetric trilayers
F. Ajejas; R. Guerrero; R. Miranda; S. Pizzini; J. Camarero; P. Perna.

Universality of anisotropic magnetoresistance in spintronics systems
F. Ajejas, P. Perna, D. Maccariello, JLF Cuñado, A. Bollero, JL Prieto, M. Muñoz, J. Camarero & R. Miranda

Unravelling chiral Dzyaloshinskii-Moriya interaction at Graphene/FM interface
Adrian Gudin; R. Guerrero; Alberto Anadon; M. Valvidares; P. Gargiani; S. Pizzini; M. Varela; R. Miranda; J. Camarero; P. Perna

23/07/2018
III Simposio Anual en Química Avanzada, Madrid, Spain

Oral Contribution

A Robust and Unique Iron(II) Mosaic-like MOF Architecture
E. Fernandez-Bartolomé, J. S. Costa

23-27/07/2018
Topological and Correlated Electronic Materials (ToCoTronics2018), Germany

Oral Contribution

Mixed axial-torsional anomaly in Weyl semimetals
Y. Ferreiros

02-03/08/2018
Progress in electromagnetics research symposium, 40th PIERS, Toyama, Japan

Oral Contribution

Alternative Plasmonic Materials in Photovoltaics: Photocurrent Gain with Conductive Nitride Nanopillars
C. David

Metal Films with Subwavelength Holes: Optical Properties in the Scope of Nonlocal Charge Carrier Dynamics
C. David, N. A. Mortensen, J. Christensen

C. David

06/08/2018
British Society for Neuroendocrinology 2018, London, UK

Oral Contribution

Smart Nanoparticles for the Treatment of Cancer
3. Scientific report

15/08/2018
Gold2018, Paris, France

Poster Contribution

Plasmonic properties of electrolytes beyond classical nanophotonics - Nonlocal soft plasmonics
C. David

26/08/2018
European Biological Inorganic Chemistry Conference, Birmingham, United Kingdom

Poster Contributions

Aqueous dynamics of ruthenium(II) and osmium(II) arene complexes bearing a tethered carboxylate
S. Infante-Tadeo, F. Martinez-Peña, A. Habtemariam and A.M. Pizarro
Half-Sandwich Iridium(III) Complexes Bearing a Tethered Pyridine as Potential Anticancer Drugs (Highly-Commented Poster)
A.C. Carrasco, V. Rodríguez-Fanjul and A.M. Pizarro

Oral Contributions

Chemical reactions on nanostructured supported graphene analyzed by DFT calculations
M. Pisarra, C. Diaz, J.J. Navarro, B. Nieto, J. Villalba, F. Calleja, R. Miranda, E.M. Perez, A.L. Vázquez de Parga, F. Martin
Evidence of large spin-orbit coupling effects in quasi-free-standing graphene on Pb/Ir(111)
Reversible C-C bond formation in a surface reaction catalysed by graphene on Ru(0001)
J.J. Navarro, M. Pisarra, B. Nieto-Ortega, J. Villalba, C. Diaz, F. Calleja, R. Miranda, F. Martin, E.M. Perez and A.L. Vázquez de Parga
Electronic and structural properties of CoO nanoislands on Au(111) and their reactivity towards water

26-30/08/2018
7th EuCheMS Chemistry Congress, Liverpool, UK

Oral Contribution

Mechanically Interlocked Derivatives of Carbon Nanotubes
E. M. Pérez

Poster Contribution

Interfacial electron transfer in graphene quantum dot-sensitized oxides: physisorption vs chemisorption
Peng Han, Ian Cheng-Yi Hou, Hao Lu, Xiaoye Wang, Mischa Bonn, Klaus Müllen, Akimitsu Narita, E. Canovas

26-30/08/2018
Rare Earth Permanent Magnets and Advanced Magnetic Materials and Their Applications (REPM 2018), Beijing, China

Oral Contribution

Rare earth-free permanent magnet composites and flexible filament for 3D-Printing
E. M. Palmero; J. Rial; D. Casaleiz; J. de V.; A. Bollero

26-31/08/2018
34th European Conference on Surface Science, Aarhus, Denmark

Oral Contributions

Chemical reactions on nanostructured supported graphene analyzed by DFT calculations
M. Pisarra, C. Diaz, J.J. Navarro, B. Nieto, J. Villalba, F. Calleja, R. Miranda, E.M. Perez, A.L. Vázquez de Parga, F. Martin
Evidence of large spin-orbit coupling effects in quasi-free-standing graphene on Pb/Ir(111)
Reversible C-C bond formation in a surface reaction catalysed by graphene on Ru(0001)
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Electronic and structural properties of CoO nanoislands on Au(111) and their reactivity towards water

27/08/2018
Biomolecular Electronics (BIOMOLEC2018), Madrid, Spain

Poster Contribution

Spin dependent charge transfer and filtering and in chiral molecular films
M.A. Niño, F.J. Luque, P. Gargiani, I. Kowalik, D. Arvanitis, J.J. de M.

29/08/2018
ECOSS34-European Conference on Surface Science, Aarhus, Denmark

Oral Contribution

Chemical Reactions on Nanostructured Supported Graphene Analyzed by DFT Calculations
03-07/09/2018
JEMS 2018 - Joint European Magnetic Symposia, Mainz, Germany

Oral Contributions

Combined magnetic hyperthermia and drug release by hydrotalcite-coated Fe3O4 nanoparticles

Development of permanent magnet properties in gas-atomized MnAl particles
J. Rial; P. Švec; E. M. Palmero; J. Camarero; P. Švec Sr.; A. Bollero

Dynamical magnetic response of superparamagnetic iron oxide nanoparticles inside live cells
D. Cabrera, A. Coene, J. Leliaert, E. J. Artés-Ibáñez, L. Dupré, N. D. Telling, and F. J. Teran

Large spin-mixing conductance in Bi-doped Cu/YIG interfaces

Magnetization processes in FeNi cylindrical nanowires with chemical notches

Poster Contributions

High-coercive MnBi thin films with tunable particulate and continuous microstructures
M. Villanueva; C. Navío; J. Rial; E. Céspedes; F. J. Mompean; M. García-Hernández; J. Camarero; A. Bollero

Polymerized rare earth-free permanent magnet particles for bonding and 3D-printing applications
E. M. Palmero; J. Rial; D. Casaleiz; J. de V.; A. Bollero

04/09/2018
Flatlands beyond graphene 2018, Leipzig, Germany

Poster Contribution

Ultrafast and Contactless Characterization of the Conductivity in Two Dimensional Systems by THz Spectroscopy
M. Ballabio, P. Han, M. Bonn and E. Cánovas

18/09/2018
NNT 2018: 17th International Conference on Nanoimprint and Nanoprint Technologies, Braga, Portugal

Oral Contributions

Hierarchical micro-nano surface topographies by combined photo and nanoimprinting lithography
M.T. Alameda, M. R. Osorio, J. J. Hernández, A. Jacobo Martín, Daniel Granados e I. Rodríguez

Roll to Roll Pilot Line for Continuous Production of Mechanically Enhanced Antireflective Surfaces

20/09/2018
1st Oncobell Symposium, Barcelona, Spain

Poster Contribution

Oncogenic mutant p53 proteins in cancer: from molecular mechanisms to novel therapeutic strategies
M. Cordani, G. Butera, I. Dando, A. Latorre, B. Sot, M. Dondadelli, Á. Somoza

23/09/2018
8th International Workshop “Organic Electronics of Highly-Correlated Molecular Systems, Suzdal, Russia

Oral Contribution

Phthalocyanines and related compounds as components of photovoltaic and artificial photosynthetic systems
T. Torres

01/10/2018
RADIOMAG Final Meeting, Florence, Italia

Oral Contribution

Probing heat dose mediated by superparamagnetic iron oxide NPs inside live cells under alternating magnetic fields
Francisco J. Teran

02/10/2018
6th Young Polymer Scientists Conference & 10th ECNP Short Course, San Sebastián, Spain
Oral Contribution
Mechanically Enhanced Nanostructured Polymer Nanocomposite Surface
03/10/2018
10th ECNP International Conference on Nanostructured Polymers and Nanocomposites, San Sebastián, Spain

Poster Contribution
Mechanically Enhanced Nanostructured Polymer Nanocomposite Surface
07-12/10/2018
Workshop on vortex behavior in unconventional superconductors, Braga, Portugal

Oral Contribution
Topologically protected superconducting ratchet effect generated by spin-ice magnets
V. Rollano
09/10/2018
Physics and Ecology, Mahón, Spain

Oral Contribution
Spatial scales of population synchrony: effects of competition, predation and harvesting
Francisco J. Cao
09/10/2018
Physics and Ecology, Mahón, Spain

Poster Contribution
Stochastic dynamics of spatially extended population with Allee effect
Rodrigo Crespo M.
17-20/10/2018
2nd Trans Pyrenean Meeting in Catalysis (TrapCat2), Tarragona, Spain

Poster Contribution
Interplay between two type II superconductors at the nanoscale
18/10/2018
XLI Congress of the Iberian Society of Biomechanics and Biomaterials, Madrid, Spain

Oral Contribution
Design of bactericidal surfaces by using micro-nano hierarchical topographies
M.T. Alameda, M.R. Osorio, J.J. Hernández and I. Rodríguez
18/10/2018
Fises-2018, Madrid, Spain

Poster Contributions
Effects of species interactions in the spatial scales of population synchrony: competition and predation
J. Jarillo
Mechanics of Cell Constriction During Division
E. Beltrán
Mechanics, Thermodynamics and Kinetics of ligand binding to biopolymers
F.J. Cao
Optimization of the extraction of pauses in molecular dynamics
A. Tejedor
Reducción de entropía por información en flashing ratchets retroalimentadas
D. Villarubia
Stochastic dynamics of spatially extended population with Allee effect
R. Crespo
18-19/10/2018
2nd Trans Pyrenean Meeting in Catalysis (TrapCat2), Tarragona, Spain

Oral Contribution
Magnetically recoverable photocatalysts based on metal oxide nanostructures
L. González, M. E. Rabanal, G. Salas
18-19/10/2018
2nd Trans Pyrenean Meeting in Catalysis (TrapCat2), Tarragona, Spain
21/10/2018
**AVS 65th International Symposium & Exhibition, Long Beach, CA, USA**

**Oral Contributions**

**Electronic and structural properties of unary and binary nanoisland oxides based on Co on Au (111)**

**Atomicity Controlled Metallation of Porphyrinoid Species with Lanthanides on Surfaces**
B. Cirera, J. M. Gallego, R. Miranda and D. Écija

22-26/10/18
**Materials.it, Bologna, Italy**

**Oral Contribution**

**Polariton Hall effect in transition metal dichalcogenides**
L. Chirolli

23/10/2018
**European Conference on Molecular Spintronics (ECMolS), Peñíscola, Spain**

**Oral Contribution**

**Spin-signatures in single-molecule/graphene electronic devices**
E. Burzurí

23-24/11/2018
**pi-System Figuration, Japan-Spain Symposium, IMDEA-Nanoscience, Madrid, Spain**

**Oral Contribution**

**Subphthalocyanines and related compounds: Singular aromatic non-planar molecules**
T. Torres

25/11/2018
**WE-Heraeus-Seminar on MICRO & NANOSTRUCTURED BIOINTERFACES, Bonn, Germany**

**Oral Contribution**

**Design smart multifunctional surfaces by using micro-nano hierarchical topographies**
M. T. Alameda, M. R. Osorio, J. J. Hernández and I. Rodríguez

10-14/12/2018
**4th International Conference on Two-Dimensional Materials and Technologies, Melbourne, Australia**

**Oral Contribution**

**Large-area heterostructures from graphene and encapsulated colloidal quantum dots via the Langmuir-Blodgett method**

13-14/12/2018
**Discussion Meeting on Progress in Organic Optoelectronics, Madrid, Spain**

**Oral Contributions**

**Covalent Interactions and Disorder in Rare Earth Metal Organic Frameworks**
R. Wannemacher

**Exciton Dynamics in Supramolecular Polymers**
J. Gierschner

14/12/2018
**Materiales Moleculares en Castellano, Málaga, Spain**

**Oral Contribution**

**Nanoformas de carbono moleculares quirales**
N. Martín
3. **Workshops & courses (co)-organized by IMDEA Nanociencia**

**02.02.2018**  
Sino-hispanic meeting

**20.02.2018**  
Training: Jornada de Divulgación y Comunicación Científica

**22.02.2018**  
From surface science to nanotechnology

**06.03.2018**  
International Workshop on Frontiers in Chemistry of Molecular Materials

**09.03.2018**  
Kick-off meeting Spanish Photovoltaics Excellence Network

**25.05.2018**  
Workshop Mad2D

**12.06.2018**  
NANOFRONTMAG Workshop
13.06.2018
8th Early Stage Researchers Workshop

19.06.2018
Training: Science Communication in Social Networks: Twitter

25.09.2018
XX Jornada Técnica de Vacío

08.10.2018
International Workshop on Nanoscale Imaging and Manipulation in Life and Materials Sciences

13.11.2018
Nobel Prize Winners Symposium

23-25.11.2018
Japan-Spain Symposium \(\pi\)-Figuration

13-14.12.2018
Meeting on Progress in Organic Optoelectronics and Energy Conversion
4. Seminars

Wednesday January 10th 2018
Dr. Mª Carmen Ruiz Delgado
Department of Physical Chemistry, University of Malaga, Spain

Tuesday January 16th 2018
Monograph session on High Resolution Electron Microscopy
• Introducción a la ICTS Centro Nacional de Microscopia
  Prof. José González Calbet
  UCM
• Resolución de problemas científicos en materiales avanzados: Microscopía Electrónica de Aberración Corregida
  Luisa Ruiz González and Almudena Torres Pardo
  UCM

Thursday January 18th 2018
Fundamental investigations of cobalt based nanoislands as model catalyst
Dr. Jonathan Rodríguez Fernández
Interdisciplinary Nanoscience Center (iNANO), Aarhus University, Denmark

Tuesday February 13th 2018
Excitonic Nanomaterials as Photonic Building Blocks: Understanding and Controlling the Flow of Energy
Dr. Ferry Prins
Universidad Autónoma de Madrid, Spain

Tuesday February 27th 2018
Enhancing electro-optical effects with nanostructures - Spectroscopy, Optical Data Storage, Photovoltaics
Dr. Christin David
IMDEA Nanociencia, Spain

Friday March 9th 2018
Magnetic dopants on the surface of 2D heavy metal alloys and topological insulators
Dr. Miguel Ángel Valbuena
ICN2, Barcelona, Spain

Tuesday March 13th 2018
Molecular Spin Crossover Phenomenon at the nanoscale Motion, Spintronic properties and Spatio-Temporal phenomena
Dr. Azzedine Bousseksou
Laboratoire de Chimie de Coordination – CNRS, Toulouse, France

Wednesday March 14th 2018
Twist and shine: The interplay between intrachain order and photophysics for luminescent macromolecules
Dr. Aleksandr Perevedentsev
Instituto de Ciencia de Materiales CSIC, Barcelona, Spain

Thursday March 22nd 2018
Manipulating the Monolayer: Dynamic Covalent Nanoparticle Building Blocks
Dr. Euan R. Kay
EaSTCHEM School of Chemistry, University of St Andrews, North Haugh, St Andrews, KY16 9ST, UK

Tuesday April 3rd 2018
Organometallic Ir(III), Rh(III), Ru(II) and Os(II) Metallodrugs as Catalytic Anticancer Agents
Dr. Abraha Habtemariam
IMDEA Nanociencia & Universidad Autónoma de Madrid, Spain

Tuesday April 10th 2018
Arttosecond surface physics
Prof. Pedro M. Echenique
President of the Donostia International Physics Center Foundation and Professor of Physics at the University of the Basque Country, Spain

Tuesday April 10th 2018
Artificial Photosynthesis: Fate of Photoexcited States
Prof. Dong Ryeol Whang
Institute of Physical Chemistry, University of Linz, Austria

Tuesday April 17th 2018
Irreversibility and dissipation in chemical and biological systems
Prof. Juan M. R. Parrondo
Dep. Física Atómica, Molecular y Nuclear. Universidad Complutense de Madrid, Spain
Tuesday April 24th 2018
Switchable Nanomaterials Group: Monitoring Solvatochromic Effects
Dr. Jose Sanchez Costa
IMDEA Nanociencia, Spain

Thursday April 26th 2018
Materials Science at the Atomic Scale: Structure, chemical reactions and complex architectures
Dr. Alex Riss
Technical University of Munich, Germany

Monday May 7th 2018
Nanoengineered drug delivery systems for helping drugs to reach their targets
Prof. Maria José Alonso
Research Center on Molecular Medicine (CIMUS), School of Pharmacy, University of Santiago de Compostela, Spain

Tuesday May 8th 2018
Polymer-Acceptor Bulk Heterojunction Solar Cells: From Chemical Structure to Packing and Efficiency
Prof. Jean-Luc Bredas
Chemistry and biochemistry, School of Chemistry and Biochemistry, Center for Organic Photonics and Electronics, Georgia Institute of Technology, USA

Tuesday June 5th 2018
Cooperative Adsorption and Gas Separations in Metal-Organic Frameworks
Prof. Jeffrey R. Long
Departments of Chemistry and Chemical & Biomolecular Engineering, University of California, Berkeley Materials Sciences Division, Lawrence Berkeley National Laboratory

Monday June 18th 2018
Quantum geometry and anomalous transport in 2D materials
Prof. Justin Son
Nanyang Technological University, Singapore

Monday June 25th 2018
Growth and properties of $Y_3Fe_5O_{12}$ based nanoheterostructures for magnonic applications
Dr. Nikolai Sokolov
Ioffe Institute of Russian Academy of Sciences, Saint Petersburg, St.-Petersburg, Russia

Thursday June 28th 2018
Design of catalytic active species and their identification via operando methodology
Dr. Julia Herrero-Albillos
Instituto de Ciencia de Materiales de Aragón (ICMA), CSIC – Universidad de Zaragoza, Zaragoza, Spain

Friday June 29th 2018
The history of the Solar System written in Rare Earth-Free Permanent Magnets
Dr. Feng Ryan Wang
Department of Chemical Engineering, University College London, Torrington Place, WC1E 7JE, London, United Kingdom

Monday July 2nd 2018
The Energy Landscape in the Age of Sustainability
Prof. Héctor D. Abruña
E. M. Chamot Professor, Department of Chemistry and Chemical Biology. Director, Energy Materials Center at Cornell Baker Laboratory, Cornell University

Thursday, July 12th 2018
Artificial Elements”, based on High Entropy Alloys AS BUILDING BLOCKS for NOVEL Magnetic Materials suitable for Permanent Magnets
Dr. D. Niarchos
INN, NCSR Demokritos and AMEN Technologies, Athens, Greece

Tuesday, September 18th 2018
Tracking the electronic and structural configurations of water splitting catalysts for Artificial Photosynthesis
Dr. Dooshaye Moonshiram
IMDEA Nanociencia, Spain

Thursday, September 27th 2018
From Molecule to Materials
Prof. Colin Nuckols
The Sheldon and Dorothea Professor of Materials Science, Columbia University, Department of Chemistry, New York, NY 10027

Tuesday October 30th 2018
Superconductivity in twisted graphene layers: electronic structure and interactions
Prof. Francisco Guinea
IMDEA Nanociencia, Spain
Tuesday November 13th 2018
3rd IMDEA Nanociencia Nobel Prize Winners Symposium

- The Nobel Prize in Physiology or Medicine 2018 was awarded jointly to James P. Allison and Tasuku Honjo “for their discovery of cancer therapy by inhibition of negative immune regulation.”
  Dr. Pedro Roda-Navarro
  Facultad de Medicina, UCM, Spain

- The Nobel Prize in Physics 2018 was awarded “for groundbreaking inventions in the field of laser physics” with one half to Arthur Ashkin “for the optical tweezers and their application to biological systems”, the other half jointly to Gérard Mourou and Donna Strickland “for their method of generating high-intensity, ultra-short optical pulses.”
  Dr. Ricardo Arias-Gonzalez
  IMDEA Nanociencia, Spain

- The Nobel Prize in Chemistry 2018 was divided, one half awarded to Frances H. Arnold “for the directed evolution of enzymes”, the other half jointly to George P. Smith and Sir Gregory P. Winter “for the phage display of peptides and antibodies”
  Dr. Begoña Sot
  IMDEA Nanociencia, Spain

Monday November 19th 2018
Visualizing molecular structure and function in soft matter using vibrational microscopy
Prof. Dr. Sapun Parekh
Department of Molecular Spectroscopy, Max Planck Institute for Polymer Research, Mainz, Germany

Monday November 26th 2018
Bacteria under pressure: response to AFM nanoindentation and to spatially organized microtopographic surface patterns
Dr. Virginia Vadillo Rodríguez
Departamento de Física Aplicada, Universidad de Extremadura, Badajoz, Spain

Monday November 19th 2018
Can light-based therapies improve controlled drug release and therapeutic efficacy?
Dra Pilar Acedo
University College London, UK

Wednesday, November 28th 2018
Electronic spectral properties of incommensurate van der Waals structures
Dr. Bruno Amorim
Instituto Superior Técnico, Universidade de Lisboa, Portugal

Wednesday, 19th December
STM-induced light emission: from molecular LED to subnanometric optical microscopy
Dr. Guillaume Schull
Institut de Physique et Chimie des Matériaux de Strasbourg, UMR 7504 (CNRS - université de Strasbourg), Strasbourg, France
5. Projects

5.1. International programmes

5.1.1. H2020

2DSPIN
2D magnetic materials for molecular SPINtronics
Funding: H2020-MSCA-IF-2016
Specific Agreement: no 746579
Duration: 2018-2019
IMDEA Nanociencia: Dr. Enrique Burzuri

ELECNANO
Electrically Tunable Functional Lanthanide Nanoarchitectures on Surfaces
Funding: ERC-2017-CoG nº 766555
Duration: 2018 – 2023
PI: Dr. David Écija Fernández

EVO-NANO
Evolvable platform for programmable nanoparticle based cancer therapies
Funding: H2020-FETOPEN-2016-2017 nº 800983
Duration: 2018 – 2021
IMDEA Research Team: Dr. Mª Isabel Rodríguez (PI)
http://evonano.eu/

GRAPHENECORE2
Graphene-based disruptive technologies (GrapheneCore2)
Funding: H2020-FETFLAG-2017 Specific Agreement: nº 785219
Duration: 2018-2020
IMDEA Research team: Prof. Francisco Guinea

ByAXON
Towards an active bypass for neural reconnection
Funding: H2020-FETOPEN-2016-2017 no 737116
Duration: 2017-2020
Coordinated by IMDEA Nanociencia
IMDEA Research Team: Prof. Rodolfo Miranda (PI), Dr. Teresa Gonzalez (PI)
http://www.byaxon-project.eu/

A-LEAF
Towards An Artificial Leaf
Funding: H2020-FETPROACT-2016-2017 no 732840 Specific Agreement: no 696656
Duration: 2017-2020
IMDEA Research team: Prof. Rodolfo Miranda (PI), Dr. David Ecija (PI)
http://www.a-leaf.eu/

NOCANTHER
Nanomedicine upscaling for early clinical phases of multimodal cancer therapy
Funding: H2020-NMP-2015-two-stage nº 685795
Duration: 2016-2020
Coordinated by IMDEA Nanociencia
IMDEA Research Team: Prof. Rodolfo Miranda (PI), Dr. Alvaro Somoza (PI)
http://www.nocanther-project.eu/
**GRAPHENECORE1**

Graphene-based disruptive technologies (GrapheneCore1)

Funding: H2020-FETFLAG-2014 Specific Agreement: n° 696656  
Duration: 2016-2018  
IMDEA Research team: Prof. Rodolfo Miranda, Prof. Francisco Guinea, Dr. Andrés Castellanos

**SOGraph**

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

Funding: FLAG ERA Graphene Flagship. EUFramework Programme Horizon 2020 and Ministerio de Economía, Industria y Competitividad. PCIN-2015-111  
Coordinated by IMDEA Nanociencia  
Duration: 2015-2018  
IMDEA Research team: Prof. Rodolfo Miranda (PI), Prof. Francisco Guinea (PI)

**NANOLEAP**

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

Funding: H2020-NMP-PILOTS-2014 n° 646397  
Duration: 2015-2018  
IMDEA Research Team: Dr. Mª Isabel Rodriguez (PI)  
http://www.nanoleap.eu/

**MOFsENS**

Synthesis of metal-organic frameworks as optical gas sensors

Funding: M-ERA.NET, EU-Framework Programme Horizon 2020 and Ministerio de Economía, Industria y Competitividad. PCIN-2015-169-C02-01  
Duration: 2015-2018  
IMDEA Research team: Dr. Juan Cabanillas-González (PI)

**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, Industria y Competitividad. PCIN-2016-167  
Duration: 2016-2019  
PI: Dr. Alvaro Somoza

**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  
Duration: 2015-2018  
Coordinated by IMDEA Nanociencia  
IMDEA Research team: Dr. Alberto Bollero (PI)
5.1.2. Seventh Framework Programme

MOLHREOSTAT
Downhill Folding Protein Modules as conformational Rheostats: Roles in Molecular Biology and Applications in Biosensors
Funding: ERC-2012-ADG_20120314 n° 323059
Duration: 2014-2018
PI: Prof. Víctor Muñoz

MEMOTUMCELLMACH
Metallodrugs to Modulate Tumour Cell Machinery
Funding: FP7-PEOPLE-2013-CIG n° 631396
Duration: 2015-2018
PI: Dr. Ana M. Pizarro

5.1.3. European Science Foundation

RADIOMAG
Multifunctional Nanoparticles for Magnetic Hyperthermia and Indirect Radiation Therapy
Funding: ESF, 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

5.2. National Programmes
Ministerio de Economía, Industria y Competitividad

5.2.1. Subprograma Estatal de Fortalecimiento Institucional

Severo Ochoa Centre of Excellence
Ref.: SEV-2016-0686
Duration: 2017-2021
Scientific Director: Prof. Francisco Guinea

EXCELENCIA SEVERO OCHOA

5.2.2. Programa Estatal de I+D+i orientada a los Retos de la Sociedad

Call 2017

Incorporación estable de Doctores
Ref.: IEDI-2017-00902
Duration: 2017-2019
PI: Dr. Johannes Grieschner

NanoSmart
Nanoestructuras inteligentes contra el melanoma de uvea y el cancer de pancreas
Ref.: SAF2017-87305-R
Duration: 2018-2020
Pls: Dr. Álvaro Somoza and Dra. Begoña Sot
3D-MAGNETOH
Impresión 3D de imanes basados en Mn para configurar un nuevo horizonte en energía y transporte
Ref.: MAT2017-89960-R
Duration: 2018-2020
PI: Dr. Alberto Bollero

NANOLICO
Nanomateriales funcionales para la verificación de predicciones in silico de nanotermometría e hipertermia magnética
Ref.: MAT2017-85617-R
Duration: 2018-2020
PI: Dr. Francisco J. Terán

DETECTA
Desarrollo de detectores para futuras misiones espaciales en el mm/sub-mm y fir basados en materiales superconductores o de baja dimensionalidad
Ref.: ESP2017-86582-C4-3-R
Duration: 2018-2019
PI: Dr. Daniel Granados Ruiz

BiSURE
Superficies nanoestructuradas biofuncionales como nueva generación de implantes en medicina regenerativa
Ref.: DPI2017-90058-R
Duration: 2018-2020
PIs: Dra. M. Isabel Rodríguez Fernández and Dra. Teresa González

NEWMAG
Nueva generación de imanes basados en MNAL mediante impresión 3D para aplicaciones energéticas
Ref.: EUIN2017-88502
Duration: 2017-2019
PI: Dr. Alberto Bollero

LANTHACOOR
Lanthanide coordination chemistry on surfaces
Ref.: FIS2015-67287-P
Duration: 2016-2018
PI: Dr. David Ecija and Dr. Paolo Perna

COMIC
Advanced correlative microscopy of biological particles under mechanical damage
Ref.: MAT2015-66605-P
Duration: 2016-2018
PI: Dr. Cristina Flors Ong

MaNaTwee
Influence of magnetic nanoparticle heating over individual biomolecules determined by optical tweezers
Ref.: MAT2015-71806-R
Duration: 2016-2018
PIs: Dr. J. Ricardo Arias González and Dr. Gorka Salas
CARBHOM
Homogeneous Linewidth Spectroscopy of Carbon Quantum Dots
Ref.: MAT2015-71879-P
Duration: 2016-2018
PI: Dr. Reinhold Wannemacher

GLIOMATHERAPY
Immunotherapy against high-grade brain tumour with monoclonal antibody
Ref.: RTC-2015-3846-1
Duration: 2015-2018
PI: Dr. Ángel Ayuso-Sacido and Dr. Aitziber López Cortajarena

mitoDNA
Single molecule characterization of the coordinated protein activity dynamics at the human mitochondrial DNA replisome
Ref.: BFU2015-63714-R
Duration: 2016-2018
PI: Dr. Borja Ibarra

5.2.3. Programa Estatal de fomento de la investigación científica y técnica de excelencia

Call 2017

BPMDUHDMRM
Bits de nanoestructuras magneticas por nanolitografia de adn para memorias magneticas de alta densidad
Ref.: MAT2017-89868-P
Duration: 2018-2020
PI: Dr. Feng Luo

OptoCT
Espectroscopia optica de estado estacionario y resuelta en el tiempo de sistemas organicos de transferencia de carga innovadores
Ref.: CTQ2017-87054-C2-1-P
Duration: 2018-2021
PI(s): Dr. Johannes Gierschner and Dr. Larry Luer

SwipH
Metallofamacos como conmutadores sensibles al ph para su uso en nanomedicina
Ref.: CTQ2017-84932-P
Duration: 2018-2020
PI: Dra. Ana M. Pizarro

IMAN
Novel interfaces between molecules and nanomaterials
Ref.: CTQ2017-86060-P
Duration: 2018-2020
PI: Dr. Emilio M. Pérez
Call 2016

ORGENERGY
Materiales orgánicos optoelectrónicos para la energía
Ref.: CTQ2016-81911-REDT
Duration: 2017-2019
PI: Dr. Nazario Martín

GRAPHICS
Graphene hybrid switchable materiales
Ref.: CTQ2016-80635-P
Duration: 2016-2019
PI: Dr. Jose Sánchez Costa

5.2.4. Programa Estatal de Generación de Conocimiento y Fortalecimiento Científico y Tecnológico

Call 2017

Equipamiento para incrementar la productividad y la calidad de dispositivos electro-ópticos y/o superconductores del Centro de Nanofabricación
Ref.: EQC2018-005134-P
Duration: 2018-2019
PI: Dr. Daniel Granados

5.3. Regional programmes

5.3.1. Programas de Actividades de I+D entre grupos de investigación de la Comunidad de Madrid

Convocatoria Tecnologías 2017

RENM-ICM
Red Madrileña de Nanomedicina en Imagen Molecular
Ref.: B2017/BMD-3867
Duration: 2018-2021
Coordinator: Fundación para la Investigación Biomédica Hospital Gregorio Marañón
IMDEA Research Team: Dra. Cristina Flors and Dr. Álvaro Somoza

Convocatoria Tecnologías 2013

NANOFRONTMAG
Nuevas fronteras del nanomagnetismo fundamental y aplicado
Ref.: S2013/MIT-2850
Duration: 2014-2018
Coordinator: Prof. Rodolfo Miranda (UAM & IMDEA Nanociencia)
IMDEA Research Team: Dr. Alberto Bollero and Dr. Julio Camarero

PHOTOCARBON
Materiales avanzados de carbono para fotovoltaica molecular
Ref.: S2013/MIT-2841
Duration: 2014-2018
Coordinator: Prof. Nazario Martín (UCM & IMDEA Nanociencia)
IMDEA Research Team: Dr. Larry Luer
6. Fellowships and internships

6.1. International

H2020 MARIE SKŁODOWSKA-CURIE ACTIONS (MSCA)

2DSPIN
2D magnetic materials for molecular SPINtronics
H2020-MSCA-IF-2016. Specific Agreement: no 746579
Duration: 2018-2019
Dr. Enrique Burzuri

THE NETHERLANDS ORGANIZATION FOR SCIENTIFIC RESEARCH (NWO)

RUBICON Fellowship
Duration: 2017-2018
Dr. Riccardo Frisenda

CHINESE SCHOLARSHIP COUNCIL

Call 2015
Liu Zhao
China Building Materials Academy. Four years PhD fellowship.
Supervisor: Dr. Feng Luo

Chen Sun
Nanjing University of Posts and Telecommunications. Four years PhD fellowship.
Supervisor: Dr. Juan Cabanillas

Call 2012
Junqing Shi
Beijing Normal University. Four years PhD fellowship.
Supervisor: Dr. Johannes Grieschner

Call 2011
Longfei Wu
Shanghai Jiao Tong University. Four years PhD fellowship.
Supervisor: Dr. Juan Cabanillas
6.2. National

**RAMÓN Y CAJAL PROGRAMME**

**Call 2015**
Dr. Jose 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 Terán

**JUAN DE LA CIERVA FORMACIÓN PROGRAMME**

**Call 2016**
Dr. Amalia Rapakousiou

**FPI PROGRAMME**

**Call 2017. Pre-doctoral “Severo Ochoa” Grants**
Tomas Nicolás García, Daniel Moreno Cerrada, Paula Milán Rois

**Call 2016**
Patricia Bondía

**Call 2015**
Sofía Mena

**FPU PROGRAMME**

**Call 2013**
Leire de Juan

**TECHNICAL SUPPORT SPECIALIST PROGRAMME**

**Call 2016**
Isabel Ortiz

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**Obra Social “La Caixa”**

Becas postdoctorales en Centros de Investigación y Universidades Españolas, Junior Leader.
Dra. Manuela Garnica
2018-2021

**Programa de Becas de Doctorado InPhINIT.**
PhD: Raman Prajapati
2018-2021

6.3. Regional

**ATRACCIÓN DE TALENTO INVESTIGADOR PARA SU INCORPORACIÓN A GRUPOS DE INVESTIGACIÓN DE LA COMUNIDAD DE MADRID**

**Call 2017**
Ayudas para la contratación de doctores con experiencia
Dr. Enrique Cánovas Díaz 2018-2022
Dr. Enrique Burzuri Linares 2018-2022

**Ayudas para la contratación de jóvenes doctores.**
Dra. Manuela Garnica 2018
Dra. Christin David 2018-2022

**Call 2016**
Ayudas para la incorporación de investigadores visitantes. Programa de cátedras de Excelencia
Prof. Abraha Habtemariam, University of Warwick, UK
1 year 2017-2018 (UAM & IMDEA Nanociencia)
Programa Operativo de Empleo Juvenil y la Iniciativa de Empleo Juvenil (YEI)

Call 2017
Predoctorals (3 years contract. 1 year funded)
Research assistants (2 years contract funded)
Elena Sanz, Victoria López, Claudia Lozano
Technicians (2 years contract funded)
Christine Marie Arenas, Rosa María Martínez

Call 2016
Predoctorals (3 years contract. 1 year funded)
Sofía Infante, Ana Sánchez, Adrián Valle, David García, Eduardo García, Carlos Rodríguez-Pulido, María Teresa Alameda, Jennifer Sánchez
Technicians (2 years contract funded)
Javier de Vicente

Call 2015
Research assistants (2 years contract funded)
Alejandra Jacobo

6.4. Visiting students

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

IES San Isidro, Madrid. 1 week in March 2018.
Students: Marcos H. Varela, Jacobo Llavona, Karina Botoman, Pablo Sanz
Supervisors: Drs. B. Sot, Isabel Rodriguez, Alberto Anadón, Ana Mª Pizarro

IES Rosa Chacel, Colmenar Viejo. 1 week in March 2018.
Students: Daniel García
Supervisors: Dr. Alberto Bollero

IES Ramiro de Maeztu, Madrid. 1 week in March 2018.
Students: Guillermo Car, Michael Jess, Carlota Hernandez
Supervisors: Drs. Jose Sanchez Costa, F.J. Terán, Christin David

7. Academic activities

7.1. PhD Thesis

Thursday January 11st 2018
Ms. Junqing Shi
Structure-Property Relationships in Photoresponsive Molecular Materials
Supervisor: Dr. Johannes Gierschner
Universidad Autónoma de Madrid

Friday January 19th 2018
Mr. Borja Cirera
On-Surface Design of Lanthanide-Based Nanoarchitectures
Supervisors: Prof. Rodolfo Miranda and Dr. David Eciña
Universidad Autónoma de Madrid

Thursday, February 15th 2018
Ms. Beatrice Berionni
Joining Corroles and Phthalocyanines in functional porphyrinoid arrays
Supervisors: Drs. Tomas Torres and Sara Nardis
Università Degli Studi di Roma “Tor Vergata” and Universidad Autónoma de Madrid

Friday March 2nd 2018
Mr. Francisco Martínez
Reversible Activation Dynamics of Tethered Ruthenium(II) Arene Complexes
Supervisor: Dr. Ana Pizarro
Universidad Autónoma de Madrid

Friday March 23rd 2018
Ms. Teresa Naranjo
Insights into Hydrogen Bonded Systems: From Single Molecule To The Bulk
Supervisors: Drs. Emilio Perez and Borja Ibarra
Universidad Autónoma de Madrid

Friday April 20th 2018
Ms. Belén Cortés
Nanomateriales de óxido de hierro y su interacción en sistemas biológicos
Supervisors: Drs. Lucas Perez and Angel Ayuso
Universidad Complutense de Madrid
Friday April 27th 2018
Mr. David Cabrera
*Addressing the Dynamical Magnetic Response of Magnetic Nanoparticles After Interacting With Biological Entities*
Supervisor: Dr. Francisco Terán
Universidad Autónoma de Madrid

Monday April 30th 2018
Mr. Ettore Fazio
*Crosswise functionalized phthalocyanines as central cores in novel donor-pi-acceptor arrays and metalloorganic ensembles*
Supervisors: Drs. Tomas Torres and Gema de la Torre
Universidad Complutense de Madrid

Monday May 7th 2018
Ms. Longfei Wu
*Conjugated Polymer Blends for Optical Gain Applications*
Supervisor: Dr. Juan Cabanillas González
Universidad Politécnica de Madrid

Monday June 22nd 2018
Ms. Francesca Finocchiaro
*Quantum Transport and Topological Features in Two-dimensional materials*
Supervisors: Prof. Francisco Guinea López Prof. Pablo San-Jose
Universidad Autónoma de Madrid

Tuesday July 10th 2018
Mr. Juan Jesús Navarro
*Surface Chemistry on Graphene: Chemisorption, Catalysis and Molecular Manipulation*
Supervisors: Prof. Amadeo L. Vazquez de Parga and Dr. Fabian Calleja
Universidad Autónoma de Madrid

Monday, 10 September 2018
Mr. David Rodríguez San Miguel
*Processing of Imine-based Covalent Organic Frameworks*
Supervisor: Dr. Félix Zamora
Universidad Autónoma de Madrid

Friday, November 16th 2018
Ms. Leire de Juan
*Noncovalent Functionalization of 1D and 2D Nanomaterials*
Supervisor: Dr. Emilio Perez
Universidad Autónoma de Madrid

Friday, November 30th 2018
Ms. Elena Beltrán de Heredia
*Physics of cellular processes: the role of characteristic spatial scales of the cell membrane*
Supervisors: Drs. Francisco J. Cao and Francisco Monroy
Universidad Complutense de Madrid

Tuesday, December 11th 2018
Ms. Valentina Sacchetti
*Covalent and supramolecular wires in the search for electrical and thermoelectrical properties*
Supervisor: Prof. N. Martin
Universidad Complutense de Madrid

Tuesday, December 18th 2018
Mr. Alberto Martin
*Electronic and Optical Properties at the Nanoscale Studied by STM*
Supervisor: Dr. Roberto Otero
Universidad Autónoma de Madrid
7.2. External Courses and Seminars

Participation in Master’s Degrees

Universidad Autónoma de Madrid

- Master’s Degree in Molecular Nanoscience and Nanotechnology
- Master in Condensed Matter Physics and Nanoscience
- Master’s Degree in Biophysics
- Master’s Degree in Biomolecules and Cell Dynamics
- Master’s Degree in Biotechnology
- Master’s Degree in Advanced Materials and Nanotechnology
- Master’s Degree in Applied Chemistry

Universidad Complutense de Madrid

- Master’s Degree in Nanophysics and Advanced Materials
- Master’s Degree in Biomedical Physics

Universidad Carlos III de Madrid

- Master’s Degree in Nanobiotechnology

Universidad de Cádiz

- Master’s Degree in Biotechnology

External Courses and Seminars

Wednesday, 24th January 2018
Instituto de Química Física Rocasolano (CSIC), Madrid, Spain
*Attosecond science: the superslow-motion camera of physics, chemistry and ... biology?*
F. Martín

Friday, 26th January 2018
Institute Seminar: Seoul National University (Invited Tutorial), Tübingen, Germany
*Global and Target analysis of time-resolved spectra*
L. Lüer

Friday, 9th February 2018
Universitat de Barcelona, Barcelona, Spain
*Celebrating the Nobel Prize in Chemistry 2016. Mechanically Interlocked Molecules, Molecular Machines and Carbon Nanotubes*
E. M. Pérez

Wednesday, 21st February 2018
Instituto de Nanociencia de Aragón, Zaragoza, Spain
*New materials based on porous and crystalline organic polymers (COFs)*
F. Zamora

Monday, 19th March 2018
Universidad Complutense de Madrid, Madrid, Spain
*Metallodrugs: Mechanism of Action and Activation Strategies*
A. M. Pizarro

Wednesday, 4th April 2018
Universidad de las Islas Baleares, Mallorca, Spain
*Láseres de attosegundos: la cámara superlenta de la física, la química y ... la biología?*
F. Martín

Friday, 6th April 2018
Universidad de Castilla La mancha, Ciudad Real, Spain
*Metallodrugs: Mechanism of Action and Activation Strategies*
A. M. Pizarro

Thursday, 12th April 2018
Department of Chemistry, Graduate School of Science, Kyoto University, Kyoto, Japan
*Phthalocyanines and related compounds as components of photovoltaic and artificial photosynthetic systems*
T. Torres
Monday, 16th April 2018
Department of Chemistry and Biochemistry, Graduate School of Engineering, Kyushu University, Fukuoka, Japan
Phthalocyanines and related compounds as components of photovoltaic and artificial photosynthetic systems
T. Torres

Tuesday, 17th April 2018
RIKEN, Center for Emergent Matter Science (CEMS), Hirosawa, Wako, Saitama, Japan
Subphthalocyanines and related compounds: Singular aromatic non-planar molecules
T. Torres

Thursday, 19th April 2018
The University of Tokyo, Department of Chemistry, Tokyo, Japan
Subphthalocyanines and related compounds: Singular aromatic non-planar molecules
T. Torres

Tuesday, 24th April 2018
IMDEA Nanociencia, Madrid, Spain
Novel strategies to obtain room temperature sensing molecular-based switchable materials
J. Sanchez Costa

Friday, 27th April 2018
Department of Applied Physics of the University of Castilla la Mancha, Ciudad Real, Spain
Ferromagnetic manganese based ultra-thin films: structural, spectroscopic and magnetic characterization
C. Navío

Thursday, 24th May 2018
Universidad de la Laguna, La Laguna, Spain
Synthetic Chiral Carbon Nanoforms
N. Martín

Wednesday, 30th May 2018
Universidad Autónoma de Madrid, Madrid, Spain
Maximum bonding fragment orbitals
Y. Wang

Thursday, 31st May 2018
Sede de la AECC, Barcelona, Spain
Terapias Avanzadas Contra el Cáncer Basadas en Nanopartículas
A. Somoza

Saturday, 2nd June 2018
Catania University, Catania, Italy
New Materials Based on Covalent Organic Frameworks: From Design to Potential Applications
F. Zamora

Tuesday, 5th June 2018
Université de Lille, Lille, France
Photochemical tools for correlative microscopy
C. Flors

Tuesday, 12th June 2018
IFW, Dresden, Germany
Strategies against rare-earth element criticality used in permanent magnets: substitution, industrial sustainability and novel technological approaches
A. Bollero

Wednesday, 13th June 2018
Institute Seminar, Institute of Physical and Theoretical Chemistry, University of Tubingen, Tübingen, Germany
Maximizing performance in all-small molecule solar cells with non-fullerene acceptors
L. Lüer

Thursday, 14th June 2018
San Sebastián International Physics Center (DIPC), San Sebastian, Spain
Attochemistry: imaging and controlling electron dynamics in molecules with attosecond light pulses
F. Martín

Friday, 15th June 2018
Universidad del País Vasco (UPV/EHU), Bilbao, Spain
Attochemistry: imaging and controlling electron dynamics in molecules with attosecond light pulses
F. Martín
Wednesday, 27th June 2018  
Seminar. Universidad Menéndez Pelayo, Santander, Spain  
Participación en el curso “Poder económico y poder científico”  
F. Guinea

Thursday, 5th July 2018  
DIPC, San Sebastián, Spain  
Playing old physics with new materials: From PN junctions to light-matter interactions  
D. Granados

Thursday, 12th July 2018  
CNB-CSIC, Madrid, Spain  
Smart Nanoparticles for the Treatment of Cancer  

Monday, 20th August 2018  
Friedrich Schiller University, Jena, Germany  
Enhancing electro-optical effects with Nanostructures - Spectroscopy, Optical Data Storage, Photovoltaics  
C. David

Tuesday, 28th August 2018  
Centro Física de Materiales-CSIC/UPV, San Sebastián, Spain  
Probing the interaction of magnetic nanoparticles with biological entities by magnetic means  
F.J. Terán

Thursday, 30th August 2018  
National University of Singapore, Singapore  
Processability of Imine-based Covalent Organic Frameworks: Some Simple Hints  
F. Zamora

Monday, 10th September 2018  
Chalmers University of Technology, Goteborg, Sweden  
Exploring the dynamics of synthetic and biological molecular motors at the single-molecule level  
B. Ibarra

Friday, 14th September 2018  
Universidad de Valencia, Valencia, Spain  
Rotaxanes and carbon nanotubes: from synthesis to single-molecule experiments  
E. M. Pérez

Friday, 14th September 2018  
Fundación PONS Patentes, Madrid, Spain  
Nanomedicinas: de la investigación básica a las aplicaciones clínicas  
A. Somoza

Saturday, 22nd September 2018  
I.o.fo State University of Chemistry and Technology (ISUCT), I.o.fo, Russia  
Subphthalocyanines: Singular, aromatic and chiral, non-planar compounds  
T. Torres

Thursday, 27th September 2018  
Leibniz University, Hannover, Germany  
Application of the Rigorous Coupled Wave Approach (RCWA) for optical technologies in spectroscopy and photovoltaics  
C. David

Wednesday, 10th October 2018  
Instituto de Nanociencia de Aragón, Zaragoza, Spain  
Electrodeposition meets nanotechnology  
L. Perez

Wednesday, 10 October 2018  
École Polytechnique Fédérale de Lausanne, EPFL, Sion, Switzerland  
Synthetic Chiral Carbon Nanoforms  
N. Martín
<table>
<thead>
<tr>
<th>Date</th>
<th>Location</th>
<th>Topic</th>
<th>Speaker</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thursday, 11th Oct</td>
<td>École Polytechnique Fédérale de Lausanne, EPFL, Lausanne, Switzerland</td>
<td>Synthetic Chiral Carbon Nanoforms</td>
<td>N. Martín</td>
</tr>
<tr>
<td>Monday, 15th Oct</td>
<td>Department of Physics, Palermo, Italy</td>
<td>Electronic and topological properties of 2D crystals: graphene and beyond</td>
<td>L. Chirolli</td>
</tr>
<tr>
<td>Monday, 22nd Oct</td>
<td>Colegio Oficial de Ingenieros Industriales de Madrid, Madrid, Spain</td>
<td>Exposición a sustancias peligrosas a escala nano</td>
<td>G. Salas</td>
</tr>
<tr>
<td>Thursday, 25th Oct</td>
<td>Universidad de Santiago de Compostela, Santiago de Compostela, Spain</td>
<td>Láseres de attosegundos: la cámara superlenta de la física, la química y... la biología?</td>
<td>F. Martín</td>
</tr>
<tr>
<td>Monday, 5th Nov</td>
<td>Max-Planck Institut for Polymer Research Johannes Gutenberg-Universität, Mainz, Mainz, Germany</td>
<td>Phthalocyanines as components for molecular photovoltaics and artificial photosynthetic systems</td>
<td>T. Torres</td>
</tr>
<tr>
<td>Wednesday, 7th Nov</td>
<td>Julius-Maximilians-Universität Würzburg, Würzburg, Germany</td>
<td>Subphthalocyanines and related compounds: Singular aromatic non-planar molecules</td>
<td>T. Torres</td>
</tr>
<tr>
<td>Friday, 9th Nov</td>
<td>Universität Erlangen-Nürnberg, Erlangen, Germany</td>
<td>Phthalocyanines as components for molecular photovoltaics and artificial photosynthetic systems</td>
<td>T. Torres</td>
</tr>
<tr>
<td>Tuesday, 20th Nov</td>
<td>Facultad de Ciencias Físicas. Universidad Complutense de Madrid, Madrid, Spain</td>
<td>Seminar of 2D Materials</td>
<td>F. Guinea</td>
</tr>
<tr>
<td>Thursday, 20th Dec</td>
<td>School of Chemistry and Biochemistry, Université de Genéve, Genéve, Switzerland</td>
<td>Synthetic Chiral Carbon Nanoforms</td>
<td>N. Martín</td>
</tr>
</tbody>
</table>
8. **Honours**

**30/04/2018**
Francisco Guinea  
Elected as “Foreign Member”  
National Academy of Sciences, USA

Nazario Martín  
Member of the European Academy of Sciences and Arts

**2018**
Tomás Torres  
Elhuyar-Goldschimid Award - Gesellschaft Deutscher Chemiker, Germany

Tomás Torres  
Fellow of the Electrochemical Society (USA)

**20.03.2018**
Alvaro Somoza  
Áccesit Award to the project NoCanTher  
Madri+d Foundation

**31.08.2018**
Ana Carrasco  
Highly Commended Poster Award  
EuroBIC14 Conference in Birmingham

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19.07.2018
Sandra Ruiz et col.  
Best Poster award  
ICMM San Francisco

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26.04.2018
J. Rial  
Concurso “Tesis en 3 minutos”  
Universidad Autónoma de Madrid

**13.06.2018**
F. J Urbanos  
Nanoscale Oral Communication Prize Award  
Nanoscale Journal

**18.07.2018**
Fernando Ajejas et col.  
Best Poster award  
ICMM San Francisco
03.10.2018
Alejandra Jacobo
Best poster presentation award
ECNP-2018 Conference in San Sebastian

07.11.2018
Ana Arché (By Axon project)
1er Premio Jóvenes Investigadores en Materiales
MATERPLAT - Plataforma tecnológica de materiales avanzados y nanomateriales

14.11.2018
Tomás Torres
Miguel Catalán 2017 Prize Comunidad de Madrid

22.11.2018
Victor Rollano
2 Premio
PhDay Universidad Complutense
9. Outreach Activities

9.1 Open doors days

This year 2018 we have received over 400 students from primary, secondary schools and universities under our Open Doors Programme “Nanociencia Para Todos”. Important is to note the attendance during the Science Week (Semana de la Ciencia) and European Researchers Night, which adds another 300 visitors from the general public, including the older generation of students.

9.1.1. Nanociencia para todos

*Nanociencia para Todos* is the outreach programme of IMDEA Nanociencia. We believe that one of our duties is to contribute to the creation of links between Science and Society in our region. For this purpose, through this programme, *Nanociencia para Todos*, we showcase the Nanoscience directly from our labs. On the year 2018, students from 17 different educational centres have visited IMDEA Nanociencia.
9.1.2. Semana de la Ciencia

9.1.3. European researchers’ night
9.1.4. **Dia de la mujer y la niña en la ciencia**

07.02.2018

Visit of secondary school “Rosa Chacel”. Opening by Rafael Van Grieken, Consejero de Educación, Juventud y Deporte de la Comunidad de Madrid

C. Flors

Madri+d/ Día Internacional de la Mujer y la Niña en la Ciencia

Encuentro entre mujeres científicas y alumnos de ESO y bachillerato de centros educativos madrileños en el Hospital Clínico San Carlos.

9.2 **Outreach activities**

08/02/2018

N. Martín

Ciclo de conferencias “Ciencia para todos”. Real Academia de Ciencias, Madrid

Bolas de azúcar de fullerenos contra el virus del ébola

22.02.2018

Fernando Martín talks at Ciencia con Encanto in Tres Cantos

26/04/2018

N. Martín

Ciclo Real Academia de Ciencias, RAC, en Casa de las Ciencias de Logroño

Bolas de azúcar de fullerenos contra el virus del ébola
15.05.2018
Lucas Perez talks for *Pint of Science*

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07.06.2018
AECC Campaign #1minutocontraelcancer — IMDEA Nanociencia dances for the charity collection against cancer

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07.06.2018
TV Commercial Ad of the Spanish Association Against Cancer AECC

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27.06.2018
Francisco Guinea — Talk “Materia condensada” at the seminar “Poder economico, poder científico” of Menendez Pelayo University.

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05.07.2018
Rodolfo Miranda at the Summer Course UCM El Escorial
24.09.2018
Alvaro Somoza at the World Cancer Research Day organized by AECC. Opening by the honorific president, her majesty the Queen of Spain

26.09.2018
Alvaro Somoza in the Spanish National Radio RNE programme “Por tres razones” – Tres proyectos innovadores contra el cáncer

25.09.2018
Alvaro Somoza participates in the project “Conocer la ciencia de hoy abre las puertas del mañana”.

28.09.2018
In the Spanish National Radio RNE programme “Por tres razones” – IMDEA CSI

Lucas Perez explains the ByAxon project at Regional Radio SER Castilla la Mancha.

29/09/2018
Á. Somoza
Researcher’s Night
CSI IMDEA joint event

02.10.2018
Ricardo Arias is interviewed by El Pais newspaper about Optical Tweezers with the occasion of the recent announcement of the Nobel Prize in Physics

18/10/2018
N. Martín
REAL ZARAGOZA Club de Tenis
Balones de azúcar de fullerenos contra el virus del ébola

24.10.2018
Youtube channel for science dissemination - NanoBioTube (Alvaro Somoza’s group)

05/11/2018
N. Martín
Semana de la Ciencia - CEU, Montepríncipe, Madrid
Nanociencia: la importancia de lo pequeño

6.11.2018
Rodolfo Miranda at Tertulias Fullbright

08/11/2018 to 06/01/2019
R. Miranda et al.
Centro de Exposiciones, Palacio de Cibeles
Stand Científico en la Exposición Conmemorativa del 50 Aniversario de la Universidad Autónoma de Madrid. UAM50: Haciendo futuro

15.11.2018
Ana Carrasco at “El científico ante los medios de comunicación” seminar, organized by the Foundation Dr. Antonio Esteve

20.11.2018
ByAxon and NoCanTher projects at the XX Conferencia del Programa Marco de Investigación de la Unión Europea

22/11/2018
N. Martín
Semana de la Ciencia - Museo de la ciencia de Orihuela (Alicante)
Charla: Nanociencia: la importancia de lo pequeño
9.3 Exhibitions

28.09.2018
Photo exhibition at the European Researchers’ night

November-December
Scientific exhibition of the 50th Anniversary of the Autonomous University of Madrid. Ayuntamiento de Madrid

10. In the media

07.02.2018
Cristina Flors and Begoña Sot visit Gredos San Diego School

04.04.2018
Festival 10alamenos9

08.05.2018
Desarrollo sostenible de nuevos imanes permanentes “Made in Europe” con un reducido impacto medioambiental
Alberto Bollero — Notiweb Madri+d

15.05.2018
Pint of Science
Lucas Perez

21.05.2018
Cómo observar el movimiento combinado de núcleos y electrones.
F. Martín, Nature Physics.

05.06.2018
Un material moderno hecho en Madrid se asemeja a un mosaico de la Alhambra del siglo XIV
31.05.2018
XII Simposio de Avances y Resultados de la Fundación AECC
Alvaro Somoza

13.06.2018
Early Stage Researchers Workshop Prizes.

22.06.2018
Interview Rodolfo Miranda CONICET Santa Fe, Argentina

11.07.2018
Anillos moleculares para controlar la actividad catalítica de los nanotubos

18.07.2018
A molecular braid
Emilio Pérez et al. Chem. Sci.
ChemSci Pick of the Week
Nanotube locked inside a porphyrin

24.07.2018
ByAxon project designed a success story of the EC-funded projects

28.08.2018
AECC Scientific Communication Award.
Alvaro Somoza

26.09.2018
IMDEA Nanociencia at the European Researcher’s Night

10.10.2018
Success of the European Researcher’s Night

15.10.2018
Metal-organic frameworks: ready for electronics
Enrique Cánovas, Nat. Mater.

25.10.2018
ByAxon FET project shine at European Researcher’s Night

Behind the paper. Editor’s highlights
Macrocycles power up carbon nanotubes

16.07.2018
Se fabrica el primer filamento de imán permanente libre de tierras raras basado en MnAl
Alberto Bollero
First rare earth-free MnAlC permanent magnet filaments for 3D printing
31.10.2018
Cinco minutos en la vida de una nanomáquina molecular
Emilio Pérez, Borja Ibarra et al. Nat. Commun

07.11.2018
Cristina Flors presents her project AMYLIGHT, funded by the Ministry of Science, Innovation and Universities, in the Joint Japan-Spain Symposium on Medical Research, with the occasion of the 150th anniversary of the establishment of diplomatic relations between Japan and Spain

05.12.2018
Grafeno y cobalto para crear nuevos dispositivos electromagnéticos – Agencia Sinc

14.12.2018
From foe to friend: graphene catalyzes the C-C bond formation

21.12.2018
Rodolfo Miranda “Los IMDEAS y la UAM”

Behind the paper. Editor’s highlights

11.2018
NEXMAG – Success story of M-Era.Net

06.11.2018
Activities of Semana de la Ciencia
11. Social networking

Twitter

The official account of IMDEA Nanociencia is the main social network for science dissemination. We have doubled our followers (from 600 in 2017) to 1200, and we have got over 600k impressions in 2018.

https://twitter.com/IMDEA_Nano

Facebook

The page of IMDEA Nanociencia in Facebook keeps its followers updated with the latest news of our institute. In 2018 we had up to 400 followers.

Youtube

IMDEA Nanociencia explains projects, research lines and publications in brief videos. The youtubers of our institute are featured in our playlists.

Linked-In

Find job offers, stay in touch with workmates. IMDEA Nanociencia has 320 followers in Linked-In.

https://www.linkedin.com/company/imdea-nanociencia/
3. Scientific report

Links

Honours

2018
https://www.gdch.de/gdch/namensvorlesungen.html
https://www.electrochem.org/fellow

07.11.2018
http://materplat.org/resolucion-de-la-primera-edicion-de-los-premios-materplat/

22.11.2018
https://fisicas.ucm.es/phday-fisicas-2018

Outreach Activities

07.02.2018
https://www.madrimasd.org/notiweb/agenda/encuentro-entre-mujeres-cientificas-alumnos-eso-bachillerato-centros-educativos-madrilenos

22.02.2018
https://twitter.com/ciencia3cantos/status/966739327647666178

07.06.2018
https://twitter.com/aecc_es/status/971385181268561922

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

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https://www.ucm.es/cursosdeverano/noticias/26906

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25.09.2018

28.09.2018

28.09.2018

02.10.2018
https://elpais.com/elpais/2018/10/02/ciencia/1538468398_951048.html

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https://www.youtube.com/channel/UCZXr8VShT6DZO_kdOL1Yq9g

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https://asoc-fulbright.es/2018/10/19/tertulia-de-noviembre-2018-el-tsunami-de-la-nanotecnologia-prof-d-rodrforo-miranda-soriano/comment-page-1/#comment-320449

08/11/2018 to 06/01/2019
https://50aniversario.uam.es/expouam50

15.11.2018
https://www.esteve.org/eventos/el-cientifico-ante-los-medios-madrid-2018/

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http://www.agenciasinc.es/Noticias/Como-observar-el-movimiento-combinado-de-nucleos-y-electrones

05.06.2018

31.05.2018
mentioned
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13.06.2018

22.06.2018
https://chemistrycommunity.nature.com/users/169710-emilio-m-perez/posts/36282-catalysts-in-mint-condition
http://www.madrimasd.org/notiweb/noticias/catalizadores-mecanizados?origen=notiweb
https://www.nanowerk.com/nanotechnology-news2/newsid=50632.php
https://www.agenciasinc.es/Noticias/Anillos-moleculares-para-controlar-la-actividad-catalitica-de-los-nanotubos

16.07.2018
https://www.lavanguardia.com/local/madrid/20180718/45954957466/fabricado-el-primer-filamento-de-iman-permanente-libre-de-tierras-raras.html

18.07.2018

24.07.2018
http://ec.europa.eu/research/infocentre/article_en.cfm?artid=49578

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https://eldiadigital.es/not/268139/nanotecnologia-contra-el-cancer/

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https://www.nanowerk.com/nanotechnology-news2/newsid=51277.php
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https://www.nanowerk.com/nanotechnology-news2/newsid=51382.php
http://www.madrimasd.org/notiweb/noticias/cinco-minutos-en-vida-una-nanomaquina-molecular
https://noticiasdelaciencia.com/art/30492/cinco-minutos-en-la-vida-de-una-nanomaquina-molecular

11.2018

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https://www.madridiario.es/461731/todas-actividades-semana-ciencia-innovacion

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http://www.ciencia.gob.es/portal/site/MICINN/menuitem.edc7f2029a2be27d7010721001432ea0/?vgnextoid=fb2c315f826c6610VgnVCM1000001d04140aRCRD&vgnextchannel=878dfb7e04195510VgnVCM1000001d04140aRCRD

05.12.2018

14.12.2018
http://www.madrimasd.org/node/42502

21.12.2018
Texto para el libro conmemorativo del Cincuenta Aniversario de la Universidad Autónoma de Madrid.
1. ELECNANO [201]
2. EVONANO [203]
1. **ELECNANO**

Electrically tunable functional lanthanide nanoarchitectures on surfaces

Lanthanide metals
Lanthanide metals are nowadays in the core of a plethora of applications including sensors, catalysis, displays, lasers, optical fibers and magnetic storage units. Their supreme characteristics for sensing, nanomagnetism and emission of light arise from their electronic structure (f orbitals) which quantum mechanics dictate the unusual chemical, optical and magnetic behaviour of lanthanides. Recent studies prospect lanthanides potential for magnetic refrigeration, quantum information and photon upconversion.

Vision and mission
The engineering of functional lanthanide-directed nanoarchitectures on surfaces remains a difficult challenge and is vastly unexplored. If solved, it could propel the development of molecular sensors, information storage units or solid state qubits/quantum gates, and light emitters, taking advantage of the supreme functionalities of the lanthanide elements. Dr. David Écija envisions to develop the field of lanthanide coordination chemistry nanodesign on surfaces with a two-fold ambition: i) the elaboration of a rationale of the physico-chemical properties of 4f coordination chemistry; and ii) the engineering of potential functional nanoarchitectures on metals, on sp² supports and on electrically tunable graphene devices.

Electrically tunable materials
The evaluation of back-gated lanthanide-directed assemblies will be used to elucidate on the physico-chemical properties upon voltage variation, focusing on electronic/magnetic structure and electroluminiscence. The exposition of these metallo-supramolecular architectures to gases will interrogate their sensitivity and selectivity, and will pave the way towards the design of single-molecule nanosensors with unrivaled resolution, which is for relevance for sensors and for optoelectronic devices.
Project details

ELECNANO is a research project funded by the European Research Council (ERC) under the Horizon 2020 framework.

**Timeframe:** 5 years (September 2018-2023)

**Budget:** ca. €2 M

**PRINCIPAL INVESTIGATOR**

David Écija Fernández (IMDEA Nanociencia)

**ADDRESSING EUROPEAN CHALLENGES**

Fascinating routes for studying novel molecular physics are ahead, of great importance for the future engineering of molecular nanodevices. The ELECNANO project will set the grounds of lanthanide coordination chemistry on surfaces, with breakthrough atomistic insights into intriguing phenomena such as molecular sensing, nanomagnetism and electroluminescence. The perspectives for functional nanodesign such as magnetic refrigeration, quantum information and photon upconversion set lanthanides as jewels for functional materials of the future, able to address important European challenges, including information and communications technology, green energy, materials and medicine.
2. **EVONANO**

Evolvable platform for programmable nanoparticle-based cancer therapies

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**Cancer therapies**

Nanoparticles are increasingly being studied in cancer research for their ability to improve diagnosis accuracy and/or deliver tailored treatments directly to tumours. However, their effective biodistribution is still a major limitation. A key challenge is to discover how to program-design the collective behaviour of trillions of nanoparticles interacting in the complex tumour microenvironment to obtain the desired therapeutic effect. We focus on designing nanoparticle-based strategies that specifically target cancer stem cells of breast and colon origin, with the aim of improving nanoparticle bio-distribution, tumour penetration and cellular uptake in target tumour tissues.

**Approach**

EVONANO uses the most recent advances in evolutionary algorithms to explore a wide range of nanoparticle designs on their ability to reach and penetrate tumours. Validation of the evolved anti-cancer nanoparticles will be done both *in vitro* thanks to IMDEA’s tumour-on-a-chip microfluidic technology that will mimic the major physiological barriers during nanoparticle tumour delivery. The most promising evolved nanoparticle designs obtained *in silico* will be synthesized and validated *in vitro* on tumour-on-a-chip devices and *in vivo* on relevant animal models.

**Mission**

EVONANO is a multidisciplinary project that will create an entirely novel nanoparticle design platform for new cancer treatments, capable of autonomously evolving both innovative and adaptive nanomedicines solutions. The proposed platform has the potential to be at the forefront of cancer nanomedicine by enabling a much faster development and assessment of new cancer treatments than is done today. The project will generate concrete simulation tools for the predictive design of effective nanomedicines.
Project details

EVONANO is a European research and innovation project funded by the Horizon 2020 FET-Open framework. Its goal is to evolve and validate novel strategies for the treatment of cancer using nanoparticles.

**Timeframe:** 3 years (October 2018-2021)

**Budget:** ca. €3 M

**Coordinator:** University of Novi Sad

An interdisciplinary consortium

EVONANO is organised around two main research hubs: in silico computational modelling (PFNS, UB, UWE and AAU) and in vitro and in vivo experimental work (IMDEA, VHIR) and nanoparticle synthesis (PCS). Partners with cross-disciplinary expertise collaborate across hubs to evolve, produce, and validate novel nanoparticle designs.

**Consortium**

University of Novi Sad (PFNS, Coordinator), University of Bristol (UB), Åbo Akademi University (AAU), University of the West of England (UWE), IMDEA Nanociencia, Prochimia Surfaces (PCS), Vall D’Hebron Research Institute (VHIR).
facilities

1. RedLab – Network of laboratories of the Regional Government of Madrid [207]
2. Center for Nanofabrication [209]
1. RedLab – Network of laboratories of the Regional Government of Madrid

278 Laboratory of Surfaces
Contact: F. Calleja

279 Laboratory of Advanced Optical Characterization
Contact: J. Cabanillas

280 Laboratory of Femtosecond Spectroscopy
Contact: L. Lüer

282 Laboratory of Nanomagnetism
Contact: P. Perna

293 Laboratory of Atomic Force Microscopy
Contact: C. Flors

349 Laboratory of Cell Cultures
Contact: A. Pizarro

363 Laboratory of Nanofabrication
Contact: D. Granados

398 Laboratory of the Instrumentation Service
Contact: F. Terán
416 Laboratory of Molecular Motors Manipulation
Contact: B. Ibarra

417 Laboratory of Oligonucleotides and Modified Particles
Contact: Á. Somoza

432 Laboratory of Nanostructured Functional Surfaces
Contact: I. Rodríguez

433 Laboratory of Catalitic Surfaces Spectroscopy in Controlled Atmosphere
Contact: M. A. Niño

435 Laboratory of Nanomaterials Characterization
Contact: Y. Luengo

436 Laboratory of Processing and Characterization of Multifunctional Materials
Contact: E. Palmero

438 Laboratory of Biomolecules Preparation for Nanotechnological Applications
Contact: B. Sot

441 Laboratory of Photovoltaic Energy
Contact: A. Molina

447 Laboratory of Electromagnetic Trials in silico
Contact: D. Ortega
2. Center for nanofabrication

Prof. Daniel Granados
Director

RESEARCH STAFF
Dr. Manuel Rodriguez
Dr. María Acebrón
Andrés Valera

The Centre for Nanofabrication is a joint proposal between the IMDEA-Nanociencia and Campus of Excellence UAM-CSIC to create a facility of excellence for the fabrication of nanostructures and devices based on a wide range of nanosciences such as 2D materials, nano-optics, photonics, nanomagnetism, bio-chemistry, micro-fluidics, nems&mems, or nanostructured organic semiconductors; among others. The fabrication of such nanostructures and devices is crucial for fundamental research, but also for the development of prospective nanotechnologies with commercial applications.

The Centre for Nanofabrication is hosted in a latest generation clean room, with more than 200m² of clean room surface and more than 500m² in total, including the technical gray area. The whole clean room is installed in a continuous solid concrete vibration isolation floor, and is fully independent of IMDEA- Nanociencia building, since it has its own foundations and services (acclimatization units, electrical power lines, water drains, earthing, gas lines, gas exhaust lines, etc.). This clean room is equipped with all the necessary equipment and safety needs required to warranty the safety, quality and purity of its installations, such as evacuation, filtering and recirculation of air as well as temperature and humidity control. Also it is equipped with all the safety equipment for the manipulation and disposal of hazardous liquids and gases to ensure the safety of the users and environment.
The clean room is divided in two main areas. The smaller section is approximately 60m² and has a certified air quality of ISO-5 (Class-100). The temperature is kept constant at 22±0.5ºC and the relative air humidity is kept constant at 50±1%. This section is devoted to lithography processes. It is equipped with electron beam Lithography (e-Beam), Focused Ion Beam Lithography (FIB), Gas Assisted Ion/Electron beam lithography (Multi-GIS), Mask-less Optical lithography and Nano-Imprint Lithography. This section is also equipped with a small wet chemistry room for all the processes related to nano and micro lithography, such as resist spinning, curing or developing.

The largest section of the clean room is about 140m² and has a certified air quality of ISO-6 (Class-1000). In this section the temperature is kept constant at 22±2ºC and the relative air humidity is kept constant at 50±5%. This part is dedicated to sample and device fabrication. The clean room is equipped with several metal thin film evaporators, a unique Atomic Layer Deposition (ALD) reactor with 12 precursor lines and 800ºC sample chuck, inductively Coupled Plasma Reactive Ion etching (ICP-RIE) for deep cryo etching of Silicon compounds, Reactive Ion Etching for Metals and Insulators (RIE), Rapid thermal Processor (RTP), Stylus Profilometer (Dektak), Oxygen Plasma, Ozone Cleaner, Optical Microscopy, Wire Bonder, Diamond Scribe, Probe Satiation and Parameter analyzer.

This section is also equipped with an encapsulation room and a large wet chemistry room for all wet chemistry related processes like wet etching and cleaning, and comprises three laminar flow hoods one for solvents and bases, one for acids and one for HF. They are all fully equipped with drying spinner, ultra-sounds bath, reflow bath, DI water weir, mega-sounds bath, etc.

The Centre has been designed to provide service to all the scientists at IMDEA-Nanociencia as well as other users at the CEI UAM-CSIC and to a limited extent, elsewhere in Madrid and Spain. The latest available state of the art fabrication technologies will be on hand for the fabrication and manipulation of metallic, semiconducting and organic nanostructures and nanoscience-based devices.

The Centre for Nanofabrication provides the researchers and users within the Cantoblanco campus of the UAM and in the framework of the Campus of Excellence project, with an efficient access to the necessary nanofabrication resources to be internationally competitive. Since IMDEA-Nanociencia is an institute created and financed jointly by the regional Government of Madrid and the Government of Spain, the Centre for Nanofabrication is intentionally planned to be able to provide under demand services of nanofabrication to researchers of public institutions as well as to private companies.
In 2009, I was offered a tenure-track position as a junior scientist at IMDEA-Nanoscience with the main objective of setting up from scratch the new nanofabrication facilities for the institute and CEI-UAM+CSIC. This involved looking for funds (2009–Now), design and construction of facilities (2009–2013), selection and purchase of equipment (2010–2012), installation and start-up (2012–2014), and managing of human/technical/budget resources (2014–Now). The Centre of Nanofabrication was fully operational in Sep. 2014. I currently supervise two research staff scientists, one process engineer, one microscopy engineer, one quality control technician. For >5 years, most of my time and effort was devoted to the success of this large and ambitious project, which is successfully up and running. Now I am in an effort to get back on the research race-track, while still managing the NanoFabLab.

One of the major achievements of the NanoFabLab in the last three years is having completed the human resources plan that was originally depicted in 2010. From 2015 to 2018 we have managed to obtain the funds and hire new personnel with well-defined complementary know how’s and skills, which will enhance the competitiveness of the Centre for Nanofabrication. Since 2018 we have 1PhD in Physics, 1PhD in Chemistry and 1 Computer and electronics engineer, together with a quality control technician and an electron microscopy engineer. Also, we have support from one M.Sc in Chemistry hired by the CABINTA-CSIC working as nanofabrication expert.

Instrumentation both for QnDG and NanoFabLab
In 2018 I have been granted a proposal to acquire: 1) A new closed-circuit helium cryostat with internal micro-positioners and a scanner with ultra-low vibrations and high lateral resolution. Optical access and electronic ports will enable many new experiments undoable until now in our lab. This tool will be installed in a new laboratory which has been set-up by the end of 2018. 2) A new e-gun evaporator for 4inch wafers which will solve the major bottleneck of the NanoFabLab.

**200m²**

of clean room surface and more than **500m²** in total

**highlight**