institute
iMdea
nanoscience

EXCELENCIA
SEVERO
OCHOA

annual report

2018

foreword

annual report 2018

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.

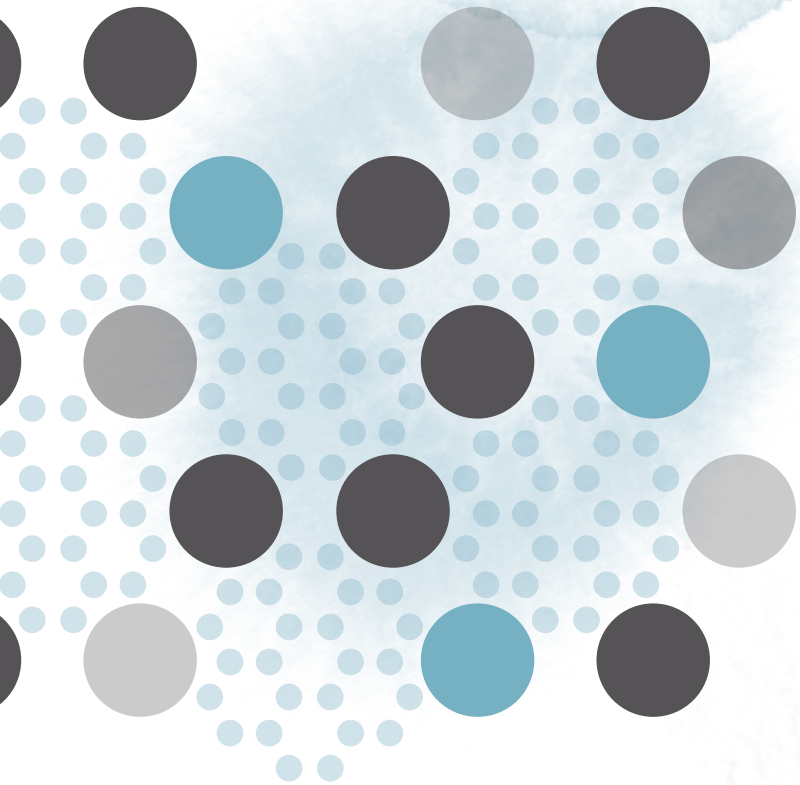
The scientific production of the Institute has maintained a level of the order of 200 papers/ year with an accumulated number of citations showing a healthy parabolic increase with time reaching 35000 by the end of the year (more than 7500 only in 2018). The institutional h index was 82.

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, as well as 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



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overview

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 IMDEANanociencia 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

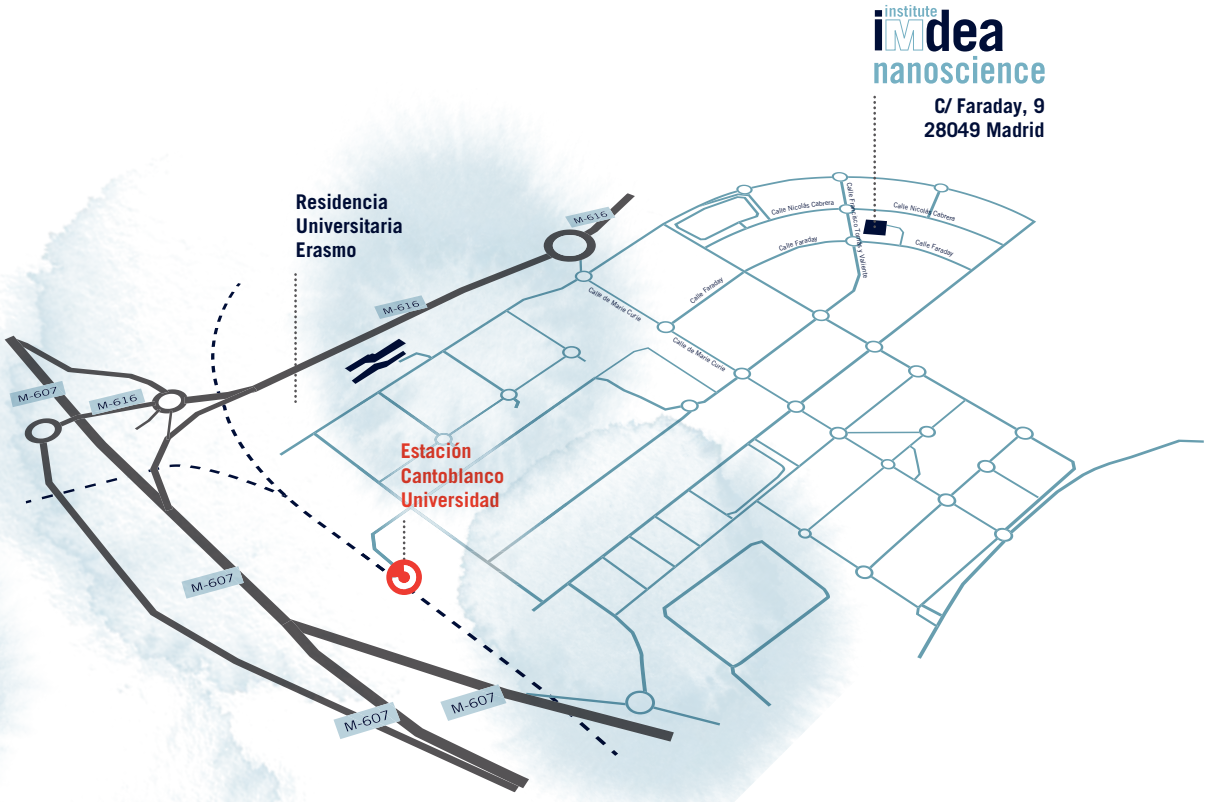
Initially, the Foundation started up its activities in spaces loaned by other academic research institutions such as the UAM School of Sciences and the UCM School of Chemistry. The new building of IMDEA is located on the Cantoblanco Campus of UAM, near Madrid. The foundation stone was laid in a public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

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

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.

IMDEA Nanociencia. Universidad Autónoma de Madrid. Cantoblanco Campus.



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.[1] Although there is still work to do to reach gender equality, IMDEA Nanociencia has a strong commitment to comply with gender equality in the workplace. IMDEA is actively promoting the appointment of outstanding female researchers with a strong emphasis on research excellence.

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.

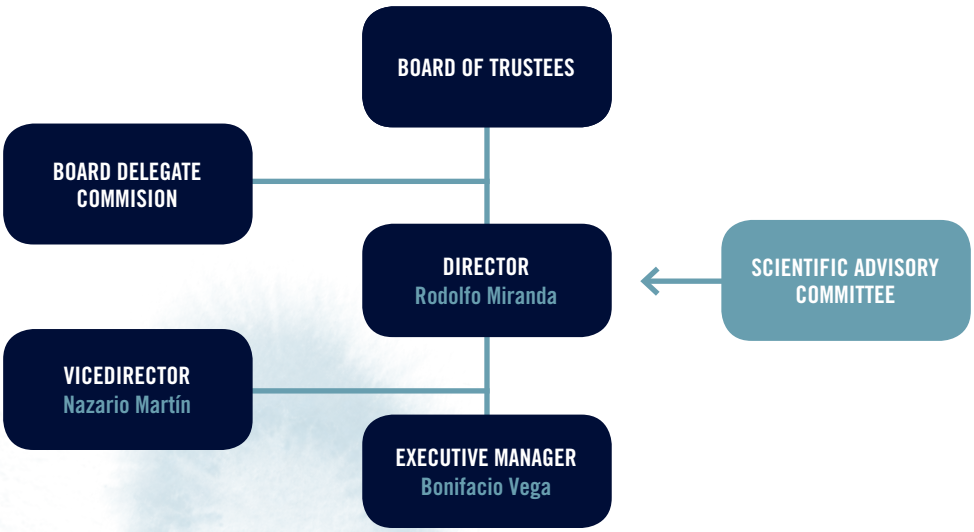
Although the award is still in its early stages, the increasing presence of IMDEA Nanociencia in the media proves the impact of the Severo Ochoa accreditation on the institute.

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.

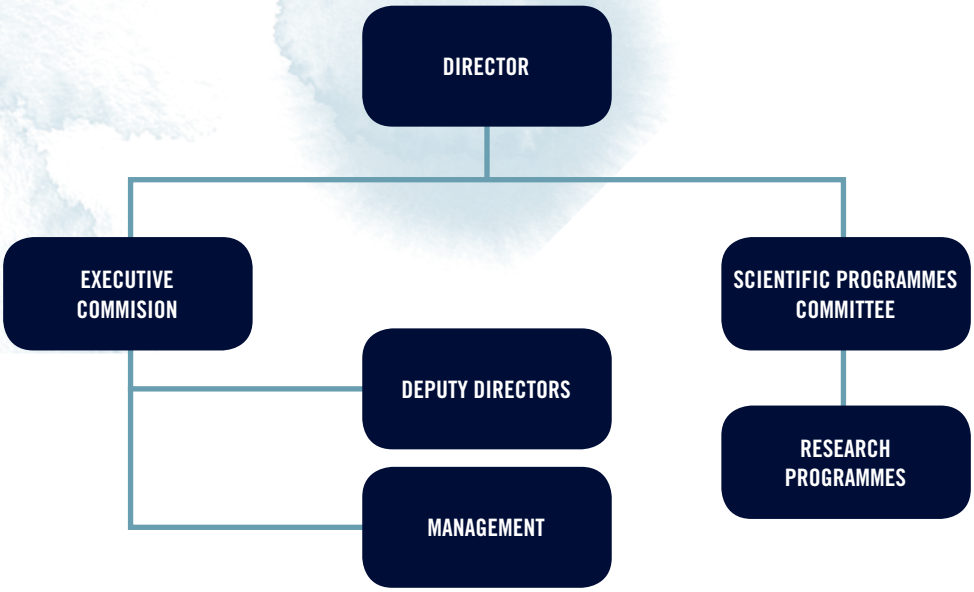
1. SHE Figures 2015, EU Commission.

7. Management Structure

Legally Binding Governing Structure



Internal Governing Structure



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

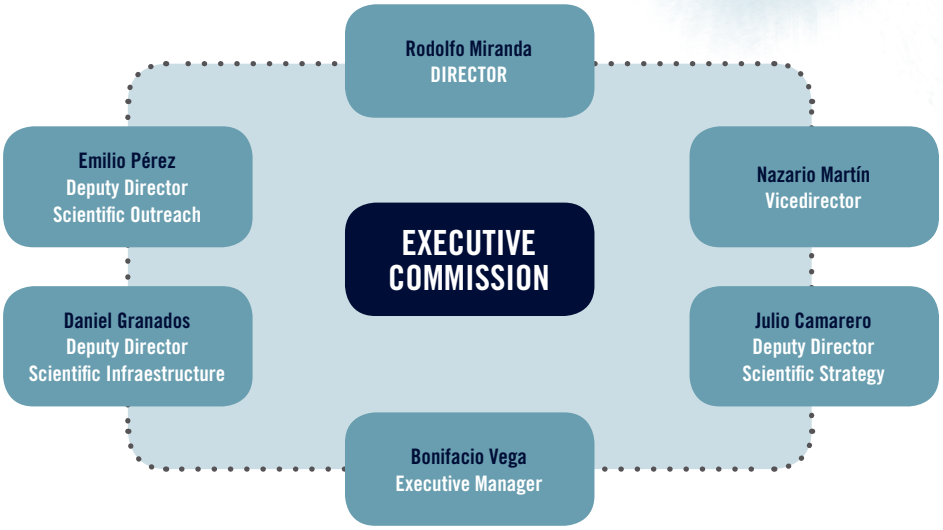
Prof.
Nazario Martín

Prof.
J. Gierschner

Prof.
Alberto Bollero

Prof.
Cristina Flors

Prof.
Emilio Pérez



8. Board of Trustees

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Prof. Cayetano López
Director of CIEMAT, Spain

Prof. Miquel Salmerón
University of California, Berkeley, USA

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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 Abruña
Department of Chemistry & Chemical Biology, Baker Laboratory, Cornell University, USA

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Department of Physics, Technische Universität München, Germany

Prof. Harald Brune
Ecole Polytechnique Féderale de Lausanne, Switzerland

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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

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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

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research programmes and scientists

annual report 2018

programme

Nanochemistry

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 Device
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

PhD: Universidad Complutense de Madrid, Spain

Double Affiliation: Universidad Complutense de Madrid, Spain

ORCID:
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Researcher ID:
B-4329-2008

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Dr. Agustín Molina Ontoria
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!**

   A most significant recent contribution from Martín's group has been the first synthesis of chiral fullerenes in a catalytic enantioselective manner, thus allowing the preparation of "chiral fullerenes a la carte" at will, under extremely mild conditions. This far-reaching achievement was published in Nature Chemistry, 2009, 1, 578 and it was followed by other seminal papers, namely Angew. Chem. Int. Ed. 2011 (cover) and J. Am. Chem. Soc., 2011; J. Am. Chem. Soc., 2014, 136, 2897-2904; J. Am. Chem. Soc., 2014, 136, 705–712; Acc. Chem. Res. 2014, 47, 2660–2670; J. Am. Chem. Soc, 2015, 137, 1190-1197 and Angew. Chem. Int. Ed., 2017, 56, 2136 –2139.

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

   Macrocylic receptors based in previous molecular tweezer have allowed to obtain amazing organic receptors for fullerenes (Angew. Chem. Int. Ed., 2013, 52, 5115-5119; Angew. Chem. Int. Ed., 2014, 53, 5629-5633. See also: J. Am. Chem. Soc., 2016, 138, 15359 (First dynamic cover issue, see: Cover JACS * November 30,2016 * Number 47 * pubs.acs.org/JACS).

Group webpage:
http://www.nazariomartingroup.com

3. On-Surface Chemistry. Exploring the 2D World Wonders

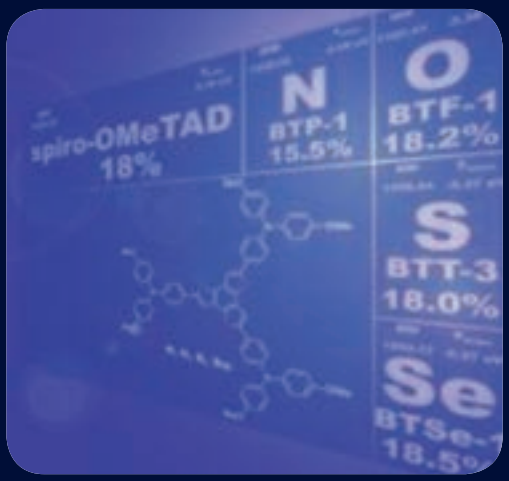
Finding new concepts and unprecedented reaction pathways for organic molecules is been enabled by ultra-high vacuum deposition on top of 2D substrates. This relatively new chemistry field allows an a la carte bottom-up design and synthesis of graphene nanoribbons and other carbon nanoforms. This line 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. Nazeerudin 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.

I. García-Benito, I. Zimmermann, J. Urieta-Mora, J. Aragó, J. Calbo, J. Perles, A. Serrano, A. Molina-Ontoria, E. Ortí, N. Martín, M. K. Nazeeruddin."Heteroatom Effect on Star-shaped Hole-Transporting Materials for Perovskite Solar Cells" *Adv. Funct. Mater.,* **2018**, -DOI: 10.1002/adfm.201801734.

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.



highlight

Chemistry of Low-Dimensional Materials

GROUP LEADER

Prof. Emilio M. Pérez

Senior Research Prof.

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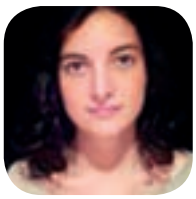

Dr. Teresa Naranjo
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Julia Villalva
Mariano Vera
Sara Moreno
Tomas Nicolás
Ramiro Quirós

TECHNICIAN

Christine Marie Arenas

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

Research Lines

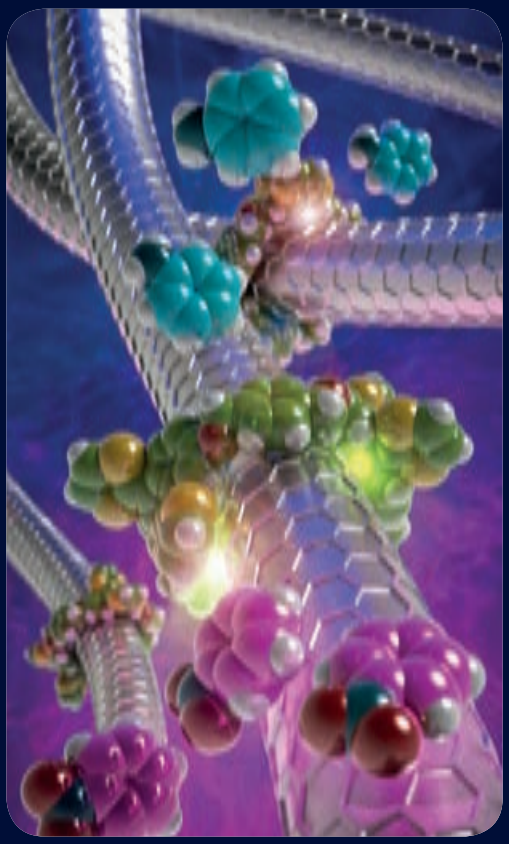
Our group has interests in three main research lines:

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 biophyisics. 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).

In control of SWNT catalyst activity: we show that encapsulation within weakly doping macrocycles can be used to modify the catalytic properties of SWNTs towards the reduction of nitroarenes, either enhancing it (n-doping) or slowing it down (p-doping). This artificial regulation strategy presents a unique combination of features found in the natural regulation of enzymes: binding of the effectors is noncovalent, yet stable thanks to the mechanical link, and their effect is remote, but not allosteric, since it doesn't affect the structure of the active site. *Nat. Commun.* 2018, *9,* 2671.



highlight

Functional Organic Materials
Hybrid Nanomaterials

GROUP LEADER

Dr. Beatriz H. Juárez
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Researcher ID:
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L-5896-2017

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Héctor Rodríguez
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Diego Ruiz

Andres Solana

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

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

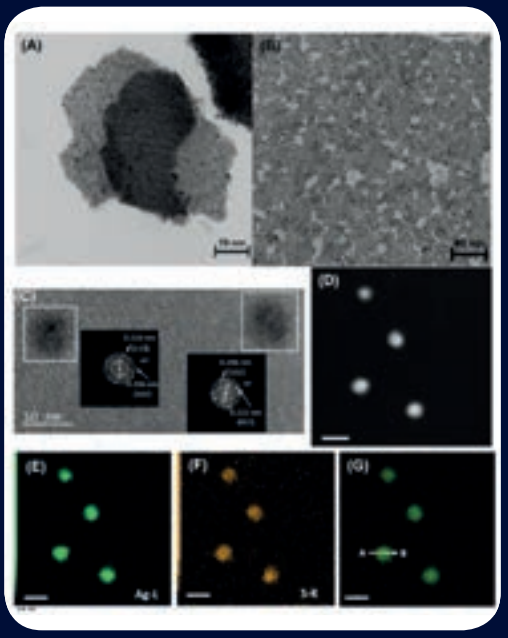
Research Lines

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.

   Special emphasis is given to surface chemistry studies by X-ray Photoelectron Spectroscopy and X-ray absorption Spectroscopy and characterization by advanced optical and microscopical techniques. (*Nano letters 17 (7), 4165-4171, 2017*; *Journal of Physical Chemistry Letters 9, 11, 3124, 2018, Nanoscale, 2019*).

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 Ag_2S 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 Ag_2S 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.



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Functional Nanoscale Materials and Devices

GROUP LEADER

Dr. Enrique Burzurí
Position: Assistant Research Prof. (tenure track)

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Research Lines

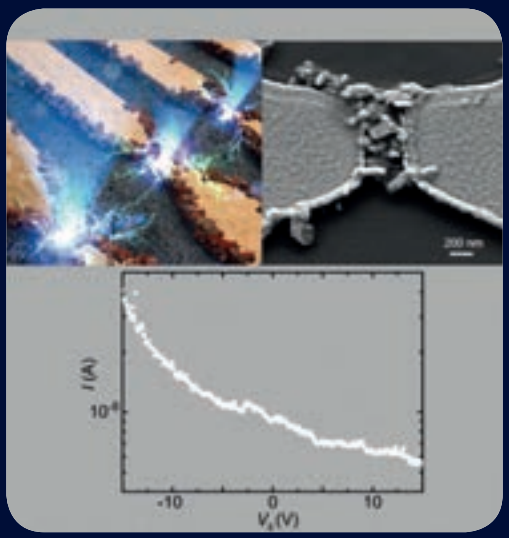
Our group has interests in three main research lines:

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.

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.



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Covalent Organic Frameworks

GROUP LEADER

Prof. Félix Zamora
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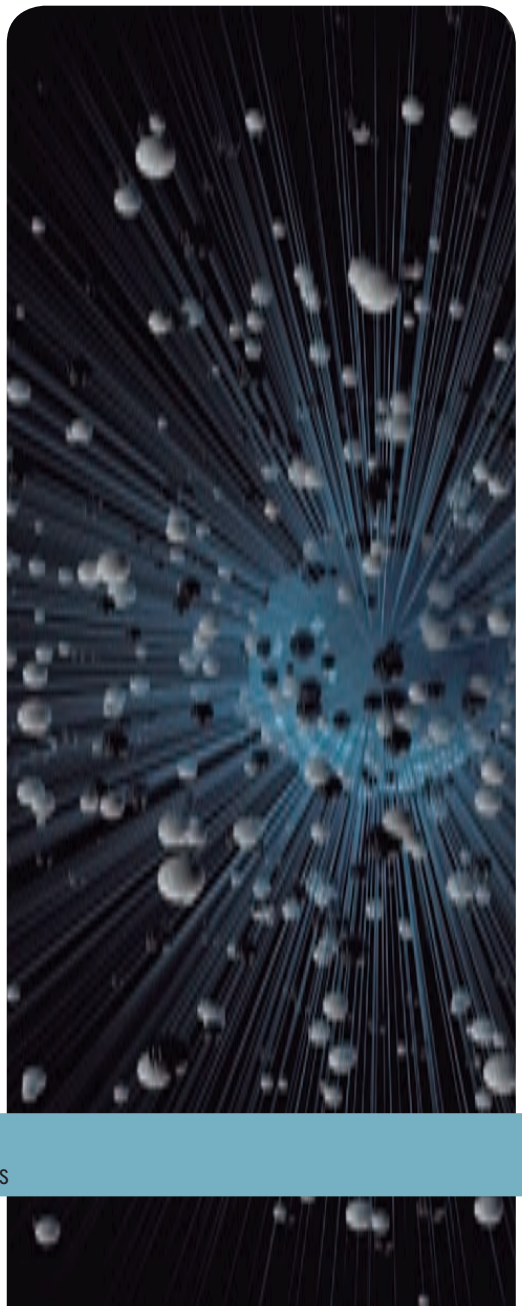


Group webpage:
https://www.nanomater.es

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:

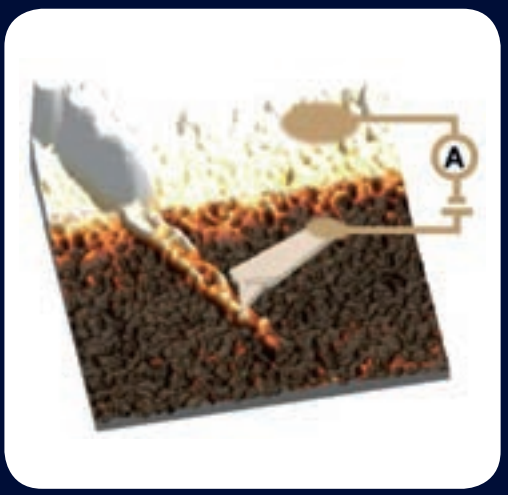
- One-dimensional coordination polymers with electrical properties, and their potential use as "molecular wires", and the use of coordination polymers of lamellar structure to produce nanometric films and monomolecular thickness *[Nature Nano 5 (2010) 110-115; Nature Commun. 4, 1709 (2013); Chem. Soc. Rev. 2010, 39, 4220–4233; Angew. Chem. Int. Ed. 56, 987 –991 (2017)]*.

- Two-dimensional materials with a rational chemical design using Covalent Organic Frameworks and Metal-Organic Frameworks: It aims to provide alternative two-dimensional materials using chemical synthesis for a rational design of structures and properties *[Adv. Matter. 25, 2141–2146 (2013); Chem Sci. 6, 2553–2558 (2015); Chem Commun 52, 4113-4127 (2016)].*

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

- Design and synthesis of porous Materials with potential applications in water and energy based on Covalent Organic Frameworks *[J. Mater. Chem. A., 5, 17973-17981 (2017); J. Am Chem. Soc. 139, 10079–10086 (2017); ACS Catal. 7, 1015–1024 (2017).].*

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.



High Electrical Conductivity of Single Metal–Organic Chains. P. Ares et.al. *Advanced Materials 30(21) 1705645 (2018)*.

highlight

Functional Organic Materials

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Research Lines

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

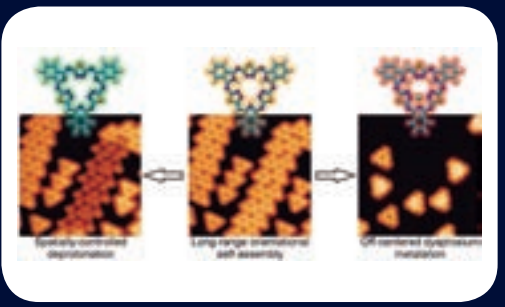
1. One research line deals with the incorporation of Pcs as active components in solar cells (*Chem. Commun.*, **2010**, *46*, 7090). We have also made significant progresses in the use of SubPcs as electron acceptors in vacuum-evaporated planar (*Adv. Energy Mater.*, **2014**, *4*, 1301413; *J. Am. Chem. Soc.*, **2015**, *137*, 8991) or bulk heterojunction solar cells (*Angew. Chem. Int. Ed.*, **2017**, *56*, 148). Similarly, we have described the use of Pcs as hole-transporting materials in perovskite-sensitized solar cells (*Adv. Energy Mater.*, **2017**, *7*, 1601733).

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).

h i g h l i g h t

Expanded porphyrins are large-cavity macrocycles with enormous potential in coordination chemistry, anion sensing, and optoelectronics. Here, we showed the self-organization capability of an "expanded hemiporphyrazine" on Au(111) through a unique growth mechanism based on long-range orientational self-assembly. Furthermore, a spatially controlled "writing" protocol on such self-assembled architecture was presented based on the STM tip-induced deprotonation of the inner protons of individual macrocycles. Finally, the capability of these surface-confined macrocycles to host lanthanide elements was assessed, introducing a novel off-centered coordination motif. See *J. Am. Chem. Soc.* **2017**, *139*, 14129.



Electrochemical Nanobiosensors

GROUP LEADER

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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).

4. Use of operando methods (Raman-electrochemistry, UV-V- electrochemistry) for the mechanistic dilucidation of electrochemically driven structural transformation or nanomaterial chemical modification (*J. Phys. Chem. C* **2018***, 122,* 12377–12383; *Electrochimica Acta* **2018***, 298,* 950-959)

Scanning electrochemical microscopy represents a powerful tool for electro(chemical) characterization of surfaces, but its applicability has been limited in most cases at microscale spatial resolution, and the greatest challenge has been the scaling down to the nanoscale for fabrication and the use of nanometer-sized tips. Here, Pt nanoelectrodes with nanometer electroactive area were fabricated and employed for imaging individual distribution of gold nanoparticles (AuNPs) and bioelectrocatalytic activity of a redox-active enzyme immobilized on gold surfaces. (See: *Nano Research.* **2018***, 11(8):* 4232-4244).

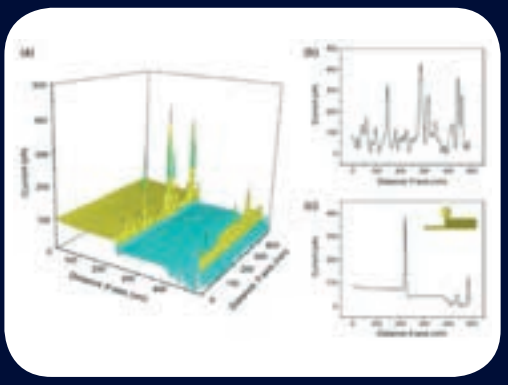

Figure (a) An SECM mapping image in feedback mode in 1 mM K2IrCl6 and 0.1 M KCl when a tip potential of 0.5 V was applied to a hexanethiol SAM-covered gold surface after 5 min of a reaction in a 2 mM 1,9-nonanedithiol solution and then in a 1 nM AuNP (5 ± 1 nm) solution for 5 min. Current profiles along (b) the Y-axis obtained at 220 nm (X-axis) or (c) the X-axis obtained at 285 nm (Y-axis), corresponding to the AuNPs immobilized on the step and schematic drawing (inset).

highlight

Switchable nanomaterials

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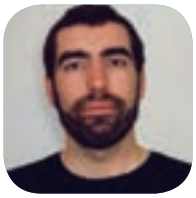

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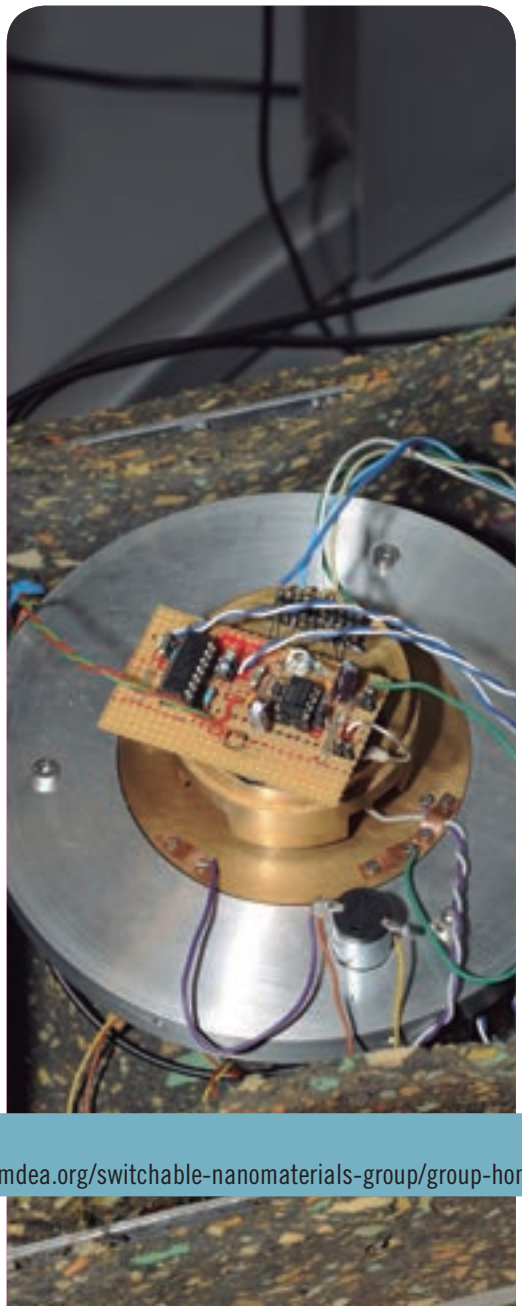

Group webpage:
http://www.nanociencia.imdea.org/switchable-nanomaterials-group/group-home

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**, *10.1039/C8CC01561A*).

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 $\{Fe(II)\text{-}F\}_n$ 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.

highlight

Synthesis of Magnetic Nanoparticles

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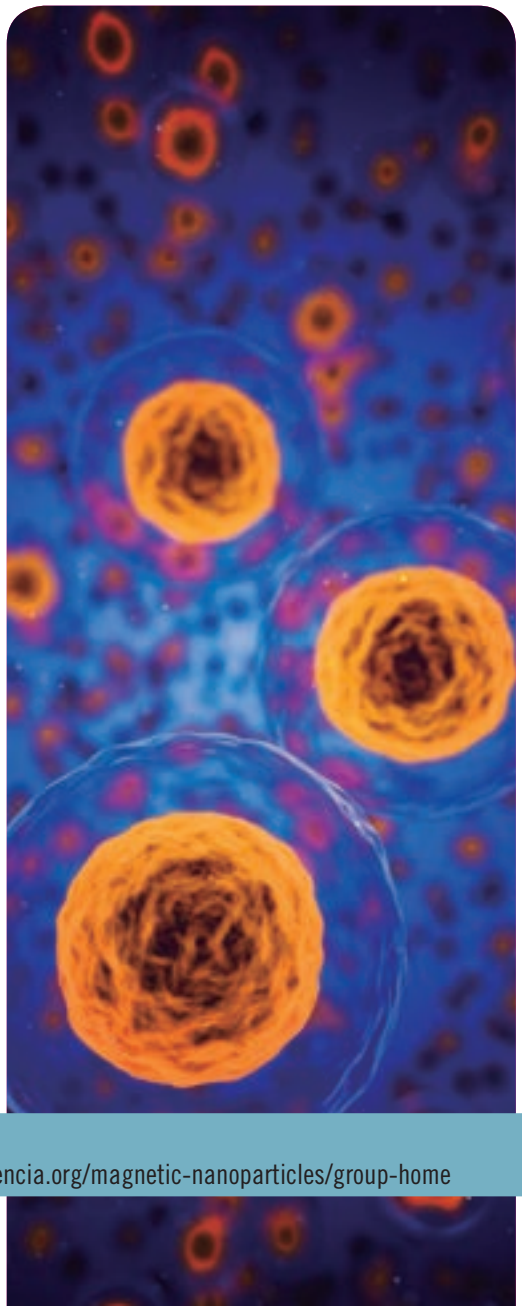


Group webpage:
http://www.imdeananociencia.org/magnetic-nanoparticles/group-home

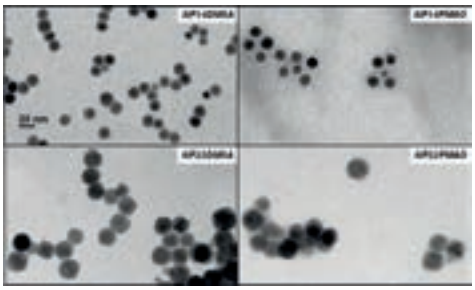
Research Lines

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 biomedial 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.



highlight

Biosensors

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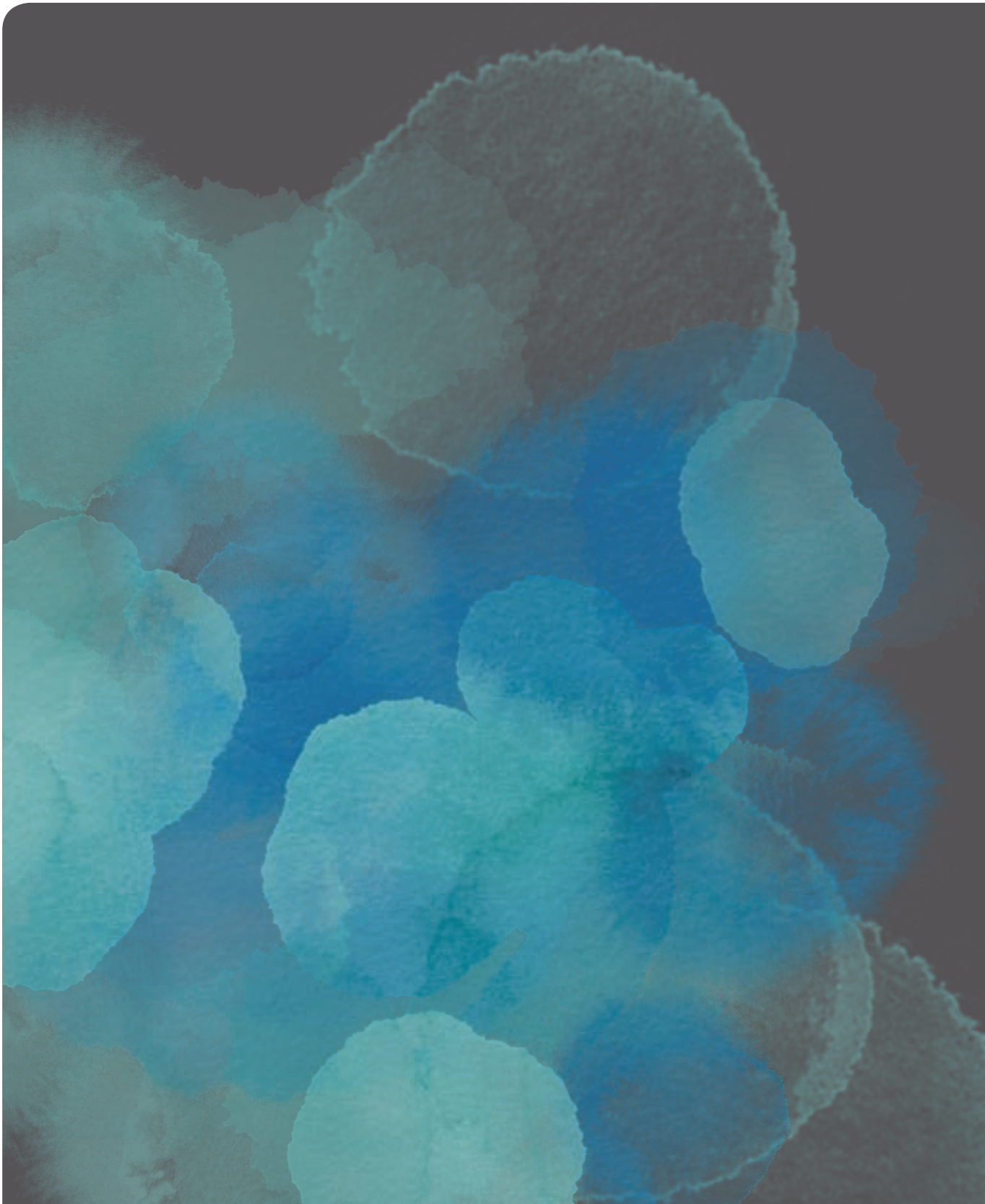
Research Lines

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:
http://www.imdeananociencia.org/home-en/people/item/dr-jose-manuel-pingarron



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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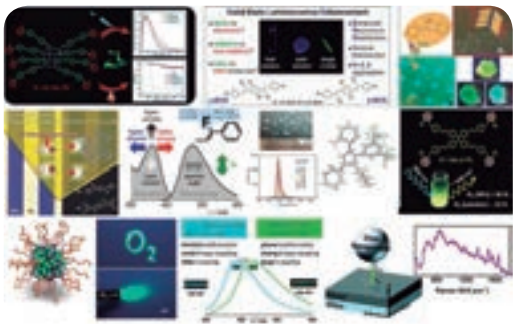

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Research Lines

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 tailormade systems for optoelectronics or fife 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

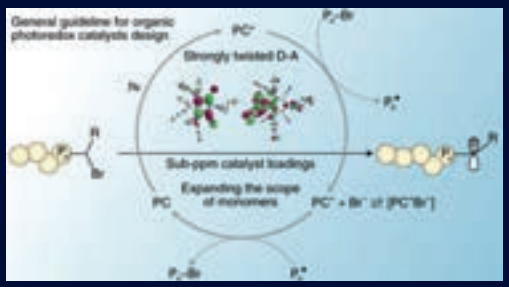
1. **Energy Conversion:** The use of organics in solar cells and as photocatalysts for water-splitting or polymerization reactions requires a profound understanding of the generation and fate of excited states; i.e. singlet and triplet state manifolds, charge transfer and localized excitons; *Nat. Catal.* **2018**, *794, Energy Environ. Sci.* **2018**, *11,* 211-220.

2. **Luminescent Organic Materials:** The understanding or even prediction of non-/occurrence of luminescence in solution and in the crystalline state is of crucial importance for targeted molecular design, where we achieve a systematic understanding using libraries of well-defined materials; *J. Phys. Chem. C* **2017**, *121,* 23166. For reviews on the matter see *Adv. Opt. Mater.* **2016**, *4,* 348, *J. Mater. Chem. C* **2013**, *1,* 5818, *J. Phys. Chem. Lett.* **2013**, *4,* 2686.

3. **Artificial Light-Harvesting** in Supramolecular Polymers for light harvesting applications requires understanding and control of molecular localized and charge-transfer excitons and their dynamics, in particular investigated by polarized techniques; *J. Phys. Chem. Lett.* **2018**, *9,* 3870, *Adv. Funct. Mater.* **2018**, *28,* 1705141.

h i g h l i g h t

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

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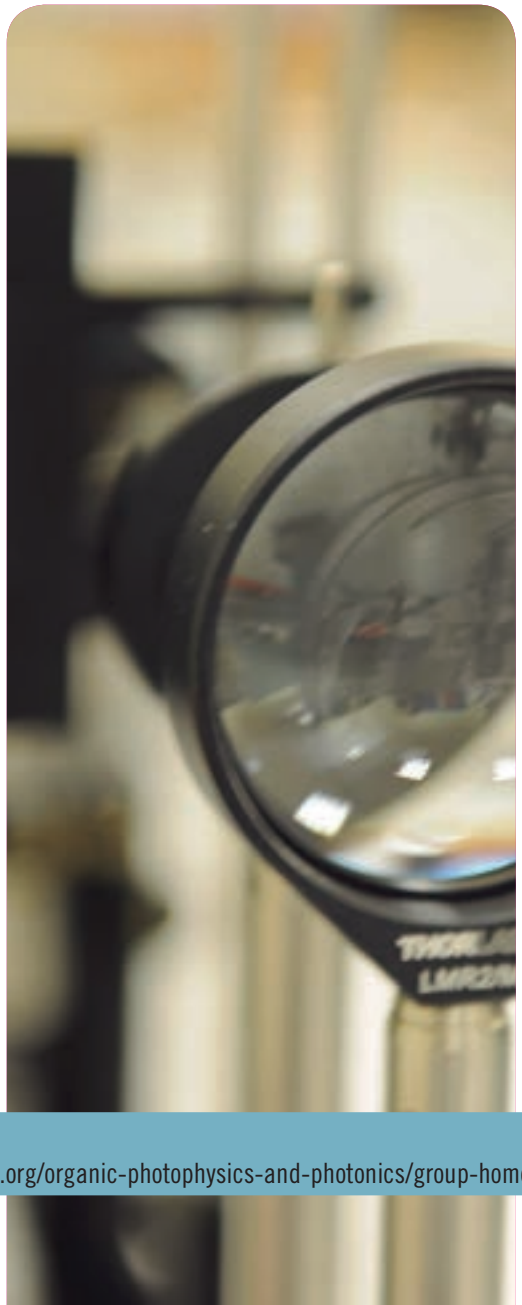


Group webpage:
http://nanociencia.imdea.org/organic-photophysics-and-photonics/group-home

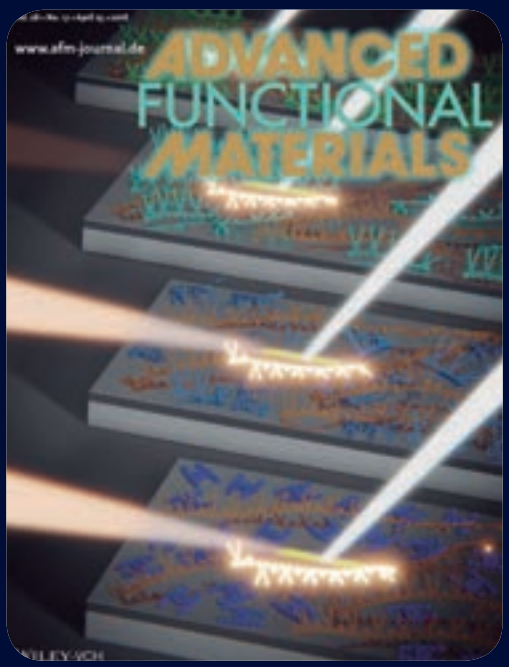
Research Lines

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 inter-chain 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, 46265*). 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*).



highlight

Femtosecond Spectroscopy on Molecular Systemson Molecular Systems

GROUP LEADER

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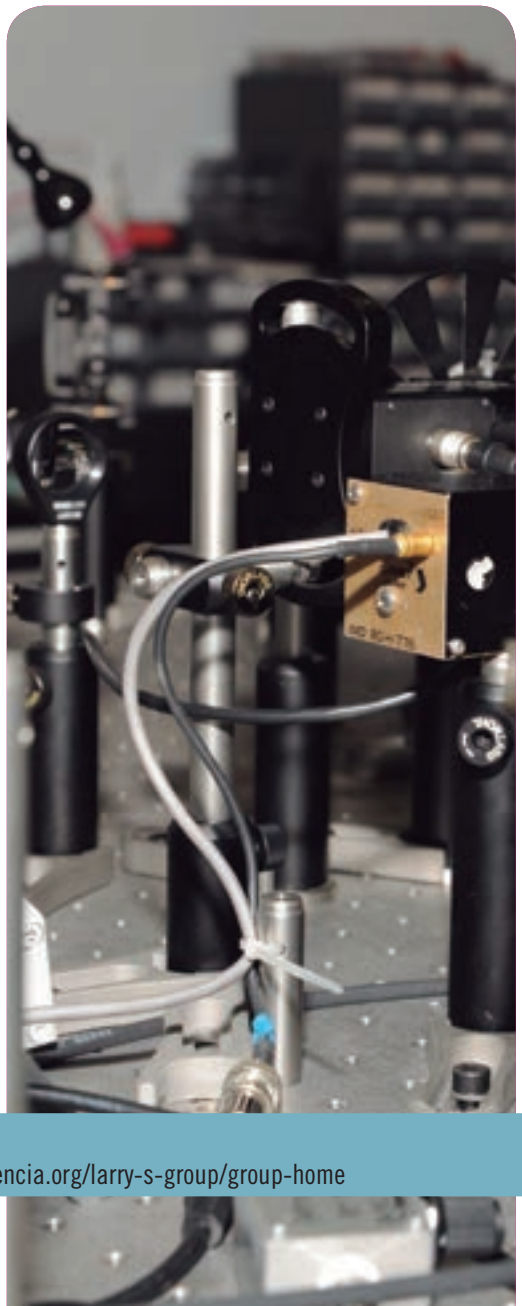

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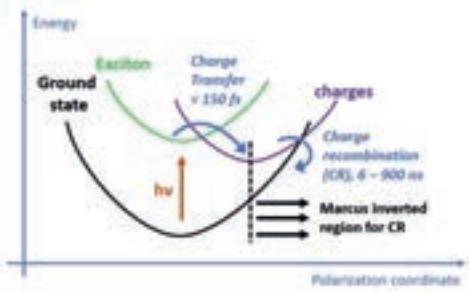
Research Lines

- **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.**

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 salf-assembling nanoparticles allow stable, efficient, and easily controllable photocatalytic wáter splitting. In a collaboration with Seoul National University, we showed that the high effieciency 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 Mat Chem. C, 2019, DOI: 10.1039/C9TC00862D*)



highlight

Nanooptics and Nanoacoustics

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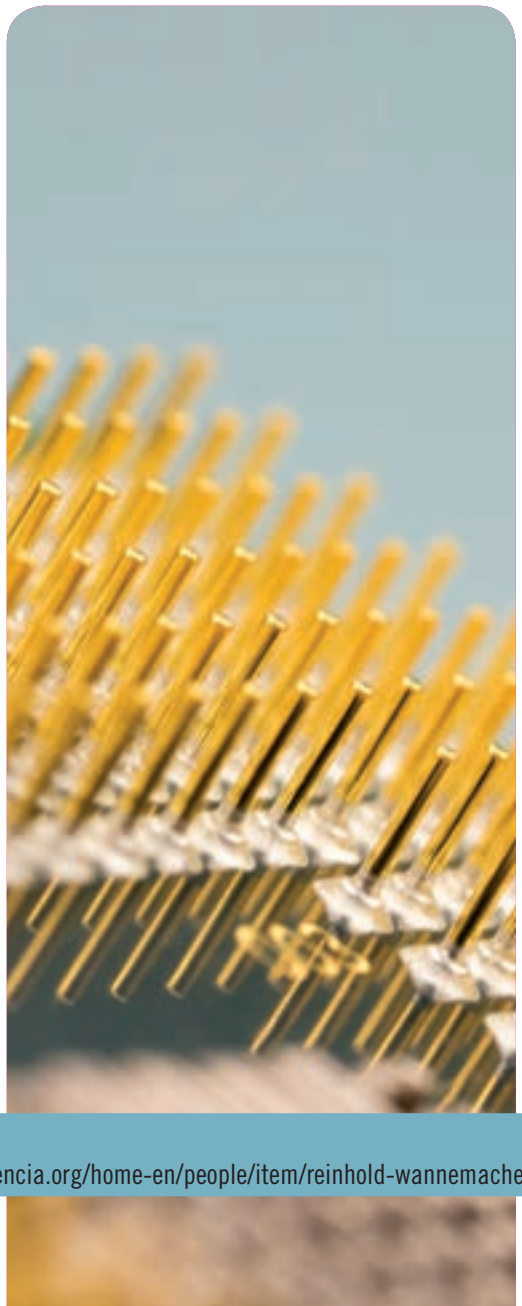


Group webpage:
http://www.imdeananociencia.org/home-en/people/item/reinhold-wannemacher

Research Lines

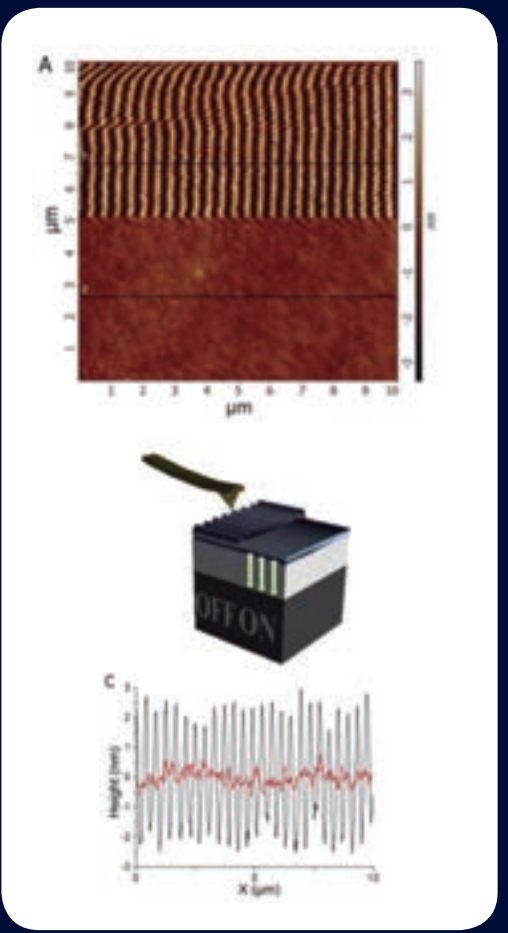
1. We are studying the photocatalytic, charge and energy transfer properties of carbon-based nanomaterials (carbon dots, graphene) in close collaboration with the groups of Isabel Rodriguez and Feng Luo, IMDEA Nanocienci.a

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



highlight

Nanostructured Photovoltaics

GROUP LEADER

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(tenure track)

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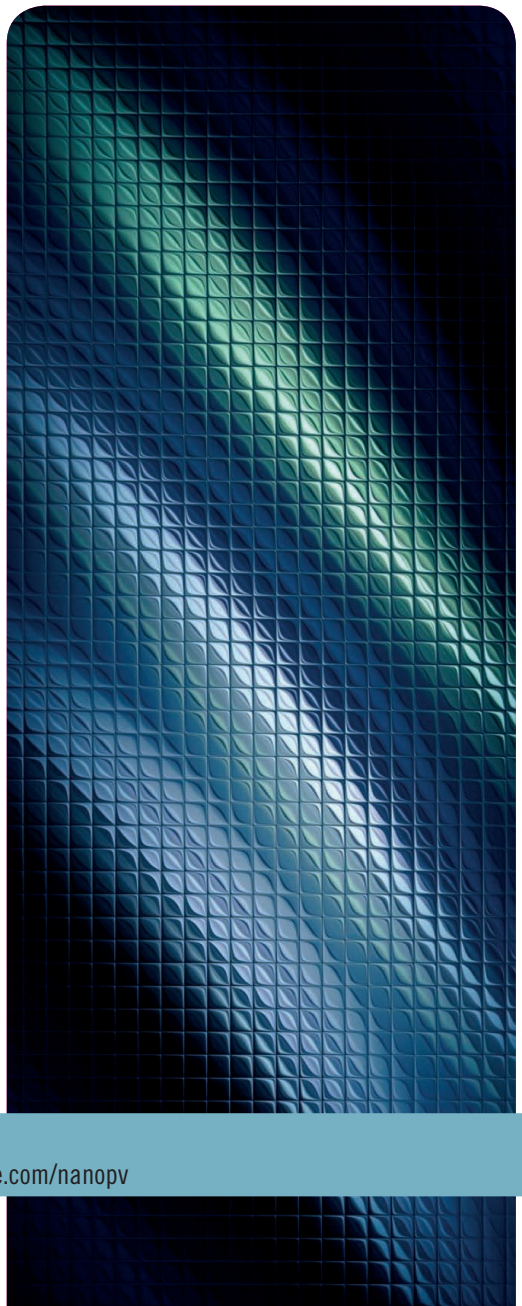
PhD STUDENTS
Sergio Revuelta



Group webpage:
https://ecanovas6.wixsite.com/nanopv

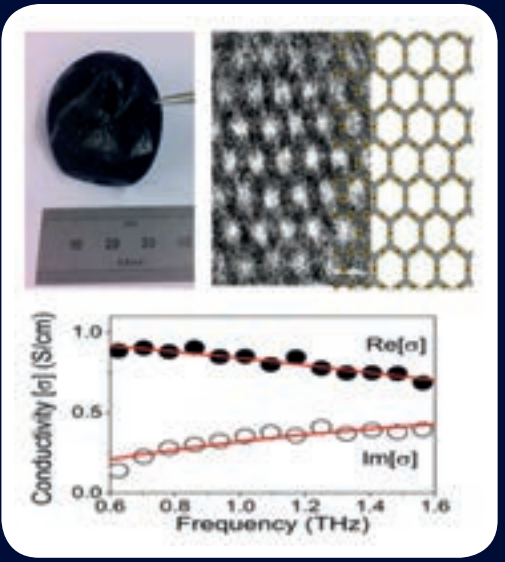
Research Lines

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**).



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Time-resolved X-ray Spectroscopy in Biological and Chemical Catalysis

GROUP LEADER

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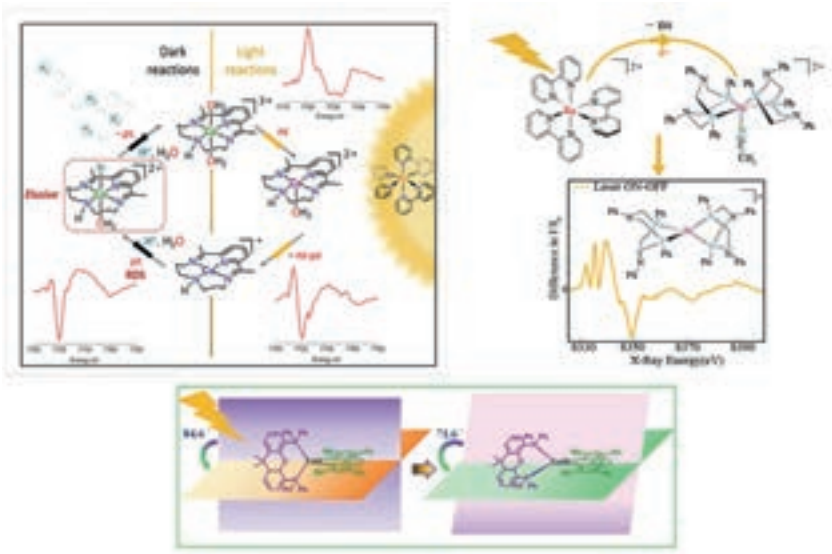

Group webpage:
http://nanociencia.imdea.org/home-en/people/item/dooshaye

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.

highlight

Our group has established several collaborations with Dr. Sanchez-Costa, Dr Luer and Dr. Wannemacher within IMDEA Nanociencia to study the time-resolved photo-induced dynamics of Iron-based spin cross-over complexes and copper-based photosensitizers involved in the hydrogen evolution reactions of artificial photosynthetic systems. These works are in the process of resulting into two high impact publications to be submitted to JACS and Chemistry, A European Journal this year.

programme

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

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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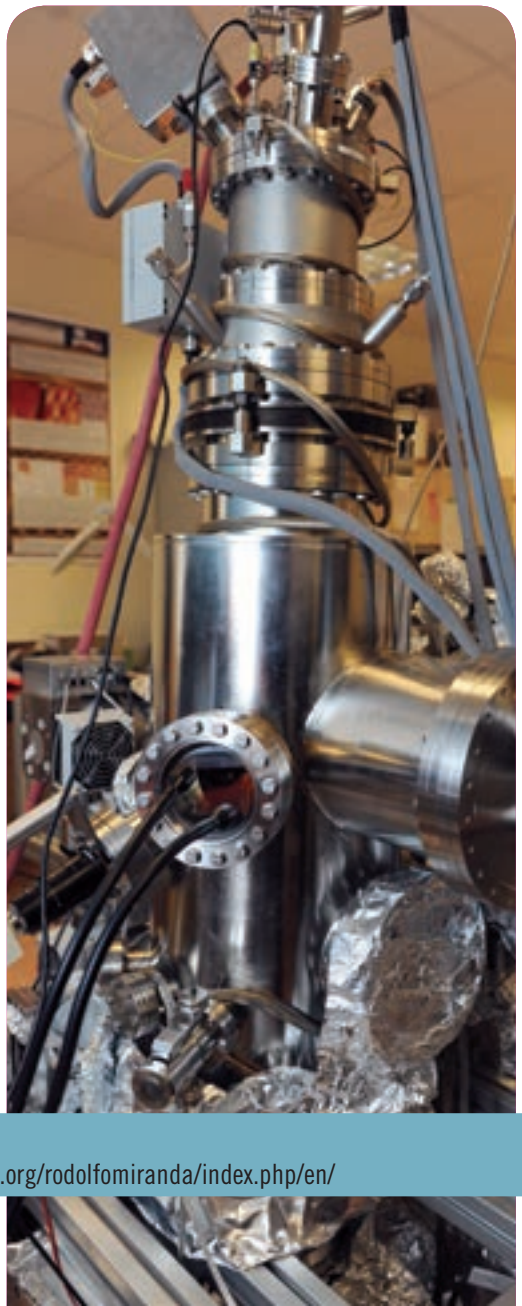


Group webpage:
http://nanociencia.imdea.org/rodolfomiranda/index.php/en/

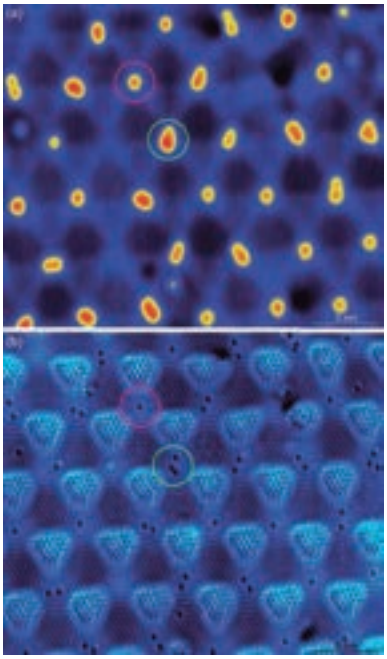
Research Lines

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$_2$, V_b = +1.7 V, I_t = 10 pA) acquired after exposing the sample at 374 K to 1080 L of CH_3CN. (b) STM image of the same area at different tunnelling parameters (17 _ 12 nm$_2$, V_b = +2 mV,I_t = 800 pA). The magenta and green circles highlight single or triple functionalized HCP-Top areas.

highlight

Imaging of 2D Materials

GROUP LEADER

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Double Affiliation: Universidad Autonoma de Madrid, Spain

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Researcher
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Previous Position: Weizmann Institute, Israel.

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(co-supervised with Dr. Calleja)

Pablo Casado
(co-supervised with Dr. Garnica)

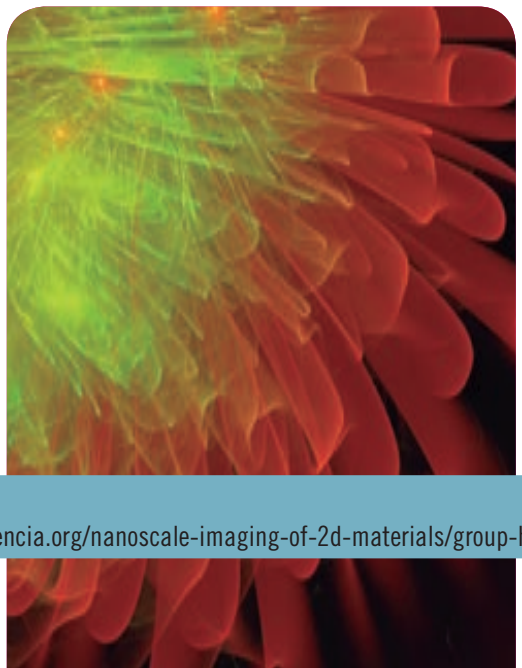
Cosme González
(co-supervised with Dr. Calleja)

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

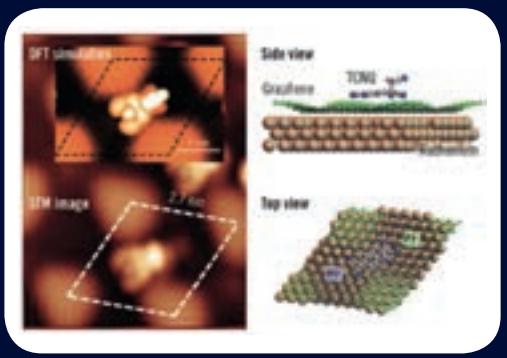
We have been exploring the superconductivity on thin films and the interaction with electron acceptor molecules.

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**)*)



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Spin-Polarized low T STM

GROUP LEADER

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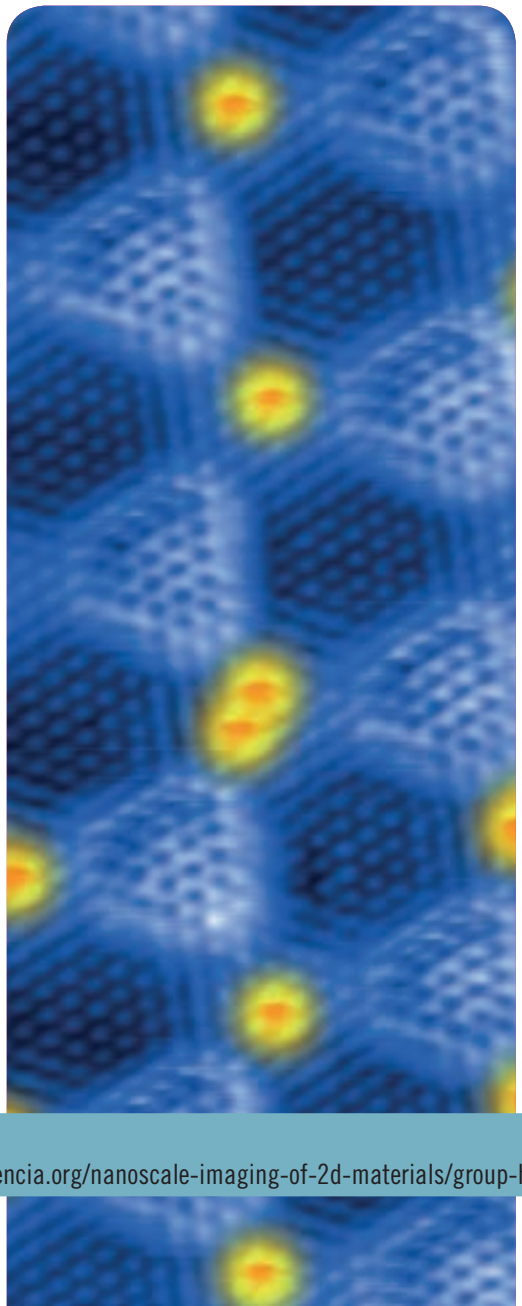
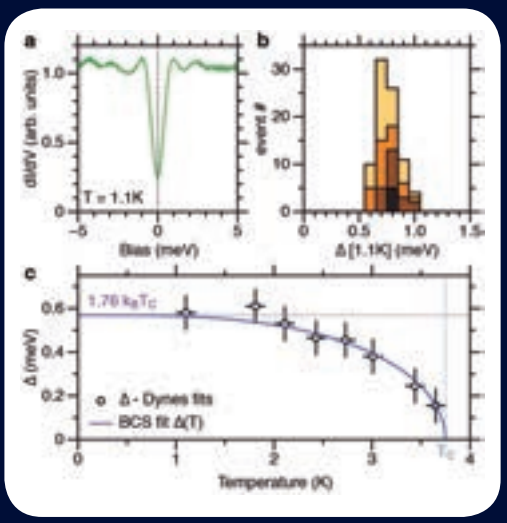


Group webpage:
http://www.imdeananociencia.org/nanoscale-imaging-of-2d-materials/group-home

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.

highlight

Topological surfaces states in quantum materials

GROUP LEADER

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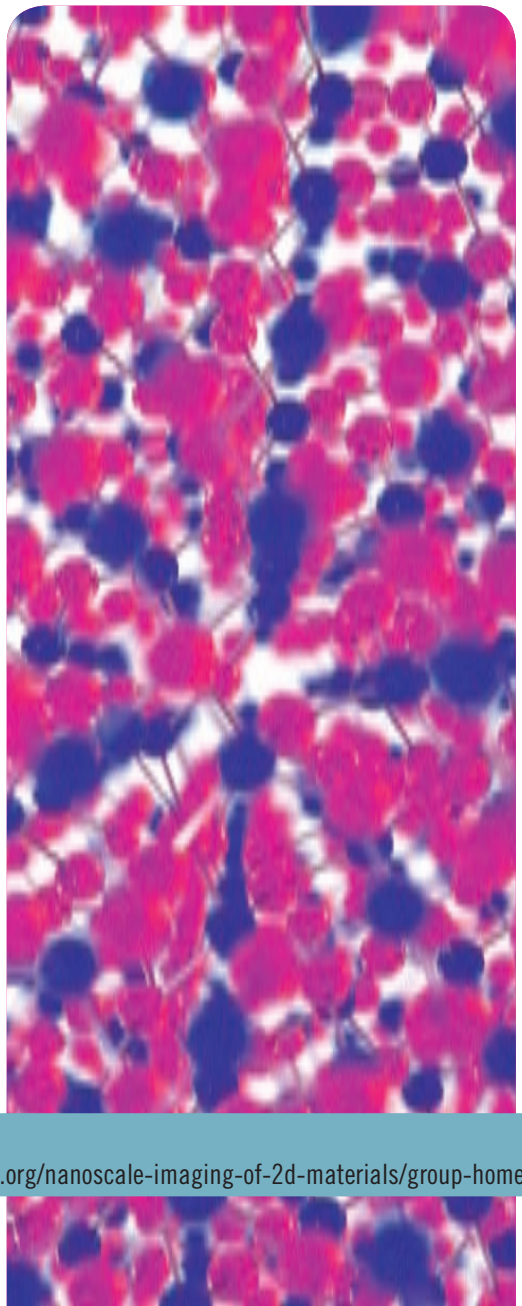

Group webpage:
http://nanociencia.imdea.org/nanoscale-imaging-of-2d-materials/group-home

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.

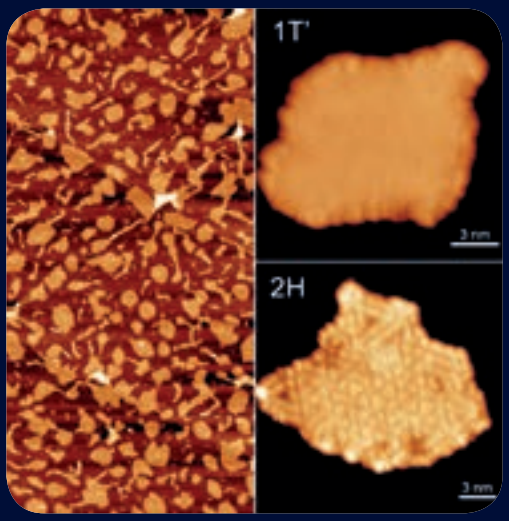

Figure. STM images of $MoTe_2$ islands grown on graphene/ Ir(111). Note that the striped island in the upper right corner corresponds to the 1T' phase, while the bottom right one shows the characteristic domain walls of the 2H phase.

highlight

Nanoarchitectures at Surfaces

GROUP LEADER

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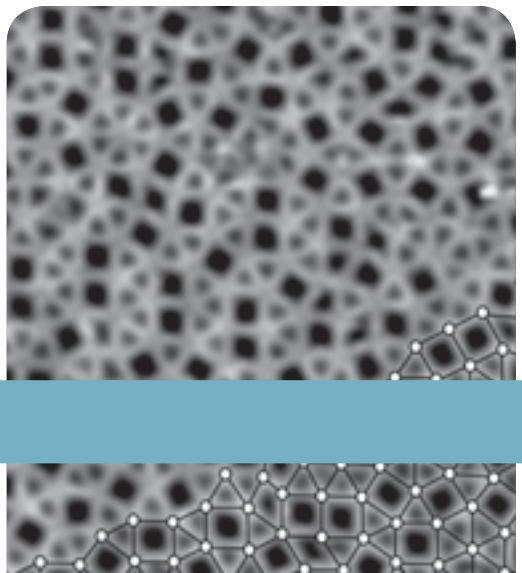


Group webpage:
http://ecija.hol.es

Research Lines

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

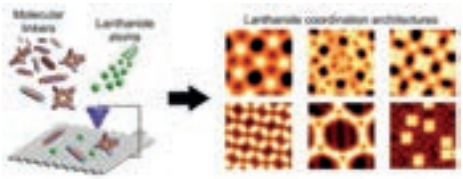
1. **Surface-confined metal-organic materials.** Our main interest is to rationalize the coordination chemistry of functional metals like lanthanides on surfaces, creating unique architectures with advanced functionalities for sensing, catalysis, light emission and nanomagnetism.

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 nanoarchitectures 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.



highlight

Fundamental Properties of Low Dimensional Systems and Quantum Materials

GROUP LEADER

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Research Lines

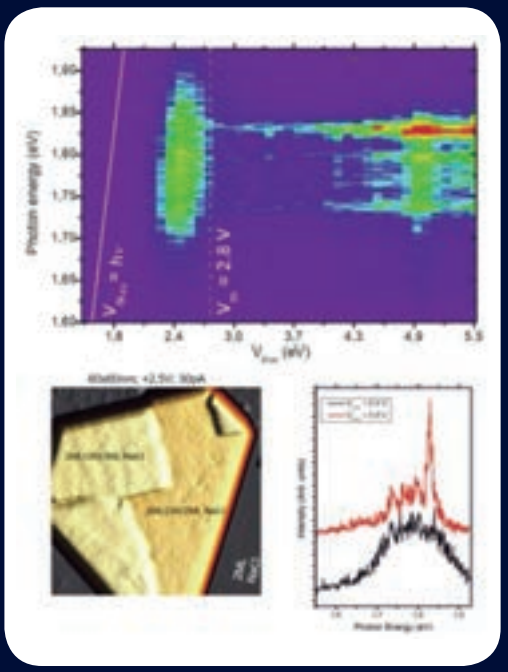
In our group we fabricate low-dimensional materials and quantum systems by deposition of organic and inorganic materials on solid surfaces, and investigate their unique properties by Low-Temperature Scanning Tunnelling Microscopy, Spectroscopy and Luminescence. In particular, we are interested in:

- 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.

STM-induced luminescence of individual C60 nanocrystals as a function of the bias voltage. The light emission can be tuned from purely plasmonic (broad spectra a lower bias voltages) to purely excitonic (sharp peaks in the spectra), where the Raman side bands can be observed.



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Molecular Electronic

GROUP LEADER

Prof. Nicolás Agraït

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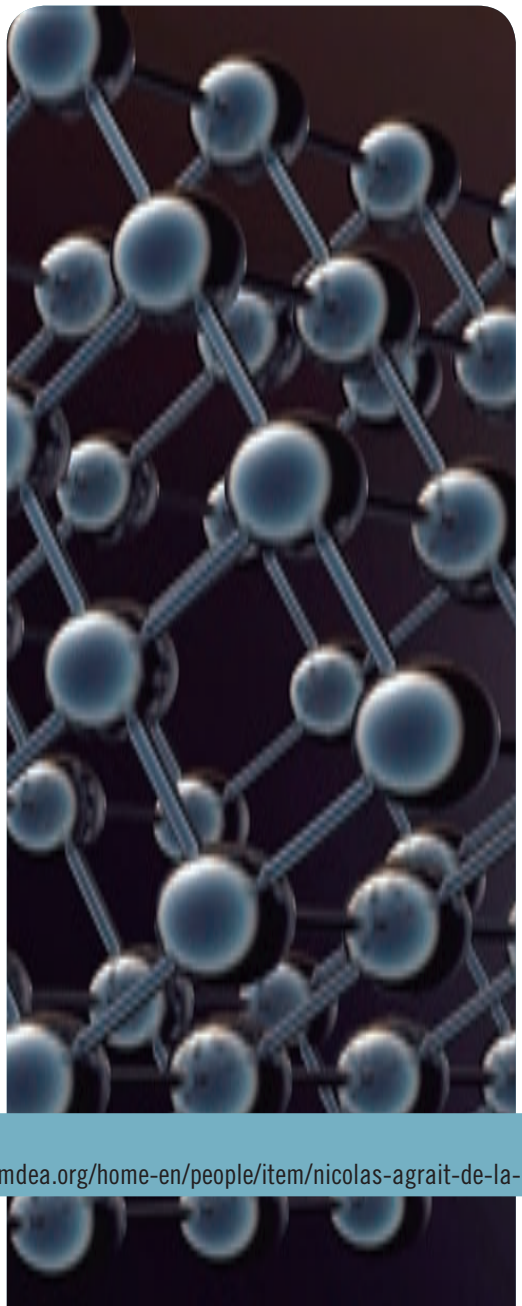

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http://www.nanociencia.imdea.org/home-en/people/item/nicolas-agrait-de-la-puente

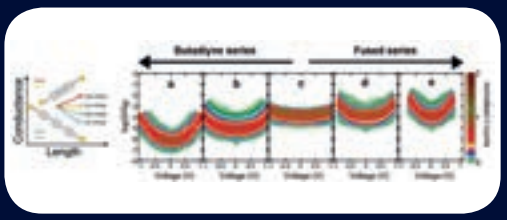
Research Lines

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 to ability to a single molecule of different compounds to generate an electrical potential when they are under a thermal gradient (Nano Lett. 2013, Nature Mater. 2016, Chem. Soc. Rev. 2016).
- Key factors involved in the formation and stability of molecular junctions (J. Chem. Phys. C 2013, J. Am. Soc. 2013, Chem. Soc. Rev. 2015, J. Phys. Chem. C 2018).
- Graphene-like molecules containing non-hexagonal rings (Chem. Sci. 2017).
- 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 (-) decreases from ca. 2 nm-1 at low bias to <1 nm-1 at 0.9 V, highlighting that -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.



highlight

Graphene

GROUP LEADER

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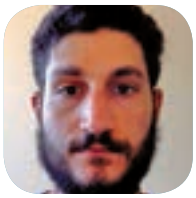

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University of Rome, Italy

Dr. Yago Ferreiros
KTH Royal Institute of Technology, Stockholm, Sweden

PhD STUDENTS
Francesca Finocchiaro
Luis González Arraga
Ignacio Vicent

Group webpage:
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.

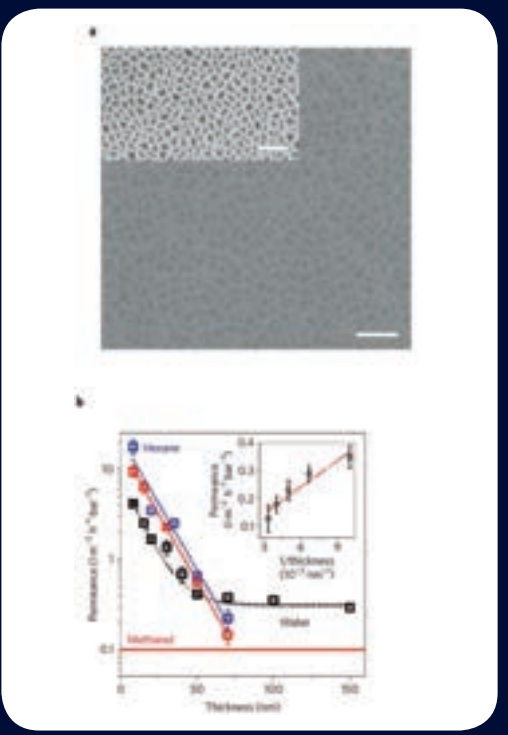
Finally, layers of different materials can be combined, leading to “metamaterials” with pre-designed features.

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 ultrafastsolvent 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 _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)



highlight

Modelling Physical Properties of Nanostructures

GROUP LEADER

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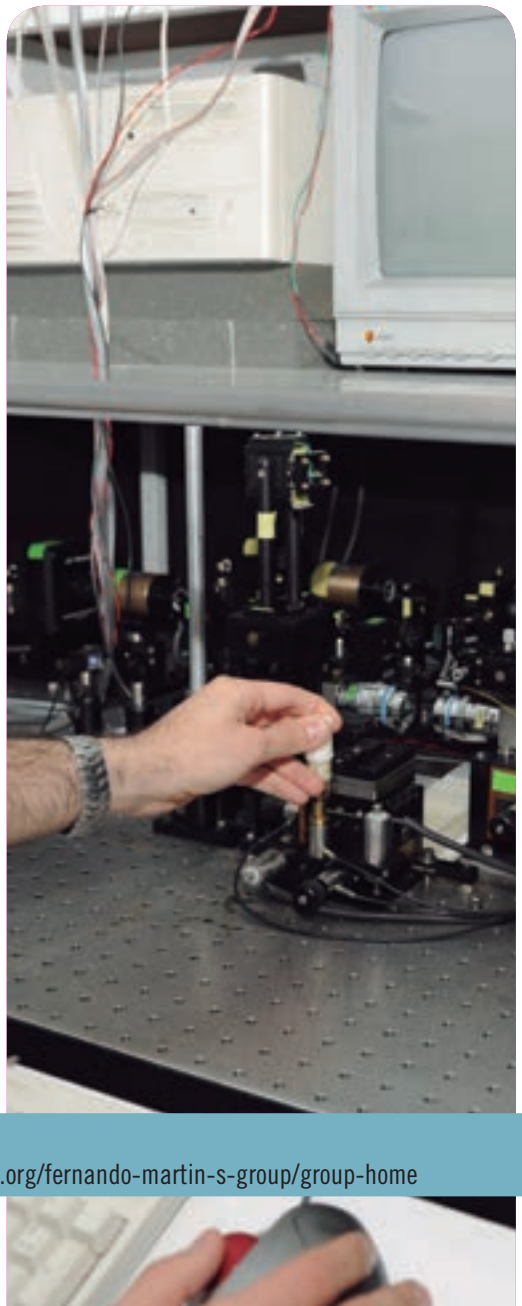

Group webpage:
http://nanociencia.imdea.org/fernando-martin-s-group/group-home

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**

highlight

Theoretical Study of Molecules on Surfaces

GROUP LEADER

Prof. Manuel Alcamí
Associate Research Professor

PhD: Universidad Autónoma de Madrid, Spain
Double Affiliation: Universidad Autónoma de Madrid, Spain

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

SpinOrbitronics
Dr. Paolo Perna

Electrodeposited nanowires
Dr. Lucas Pérez

Rare-Earth free Permanent Magnets
Dr. Alberto Bollero

Epitaxial Growth
Dr. Miguel Ángel Niño

Growth & Nanostructuring
Dr. Feng Luo

Dynamics
Dr. Francisco Terán

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 materialsand 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

GROUP LEADER

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Dr. Ruben Guerrero
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PhD STUDENTS

José Manuel Díez
Adrián Gudín

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 magnetoresitive responses.

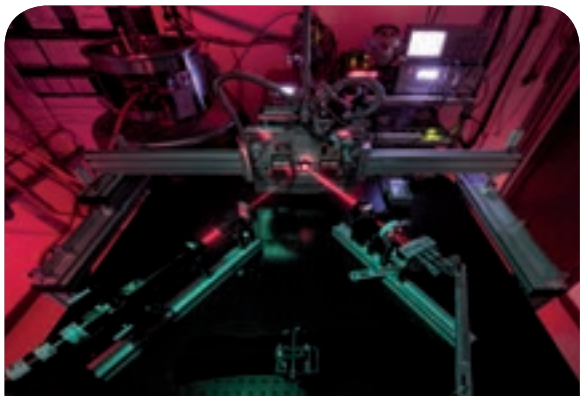
We aim at probing and understanding both magnetization reversal and transport properties of magnetic nanostructures by systematically tuning intrinsic parameters, such as magnetic anisotropy and magnetic coupling, and extrinsic ones, like temperature and external fields (including dynamic effects). The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

Magnetization reversal and magnetoresistive 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;



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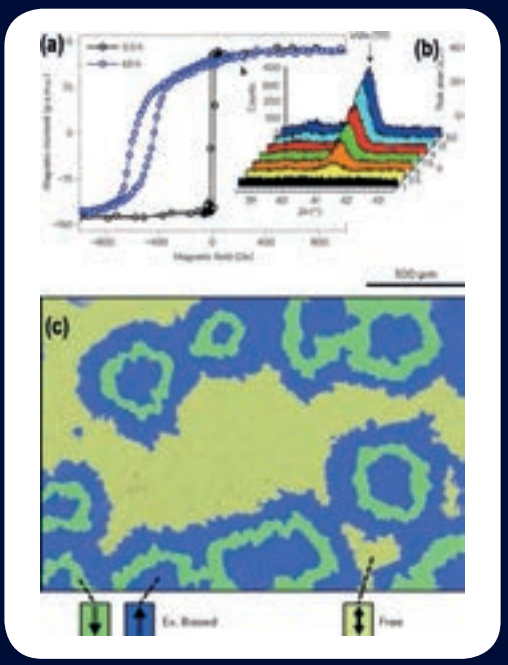
New mechanism to exchange bias a ferromagnet

Nature Materials ***17****, 28-35 (2018)*

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).

highlight

Tecnological and biomedical applications of magnetic nanoparticles

GROUP LEADER

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Group webpage:
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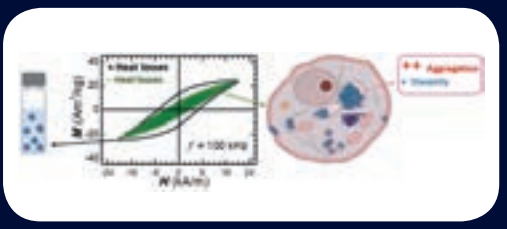
Research Lines

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)**.



highlight

Spinorbitronics

GROUP LEADER

Dr. Paolo Perna
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(tenure track)

PhD: University of Caen Basse-Normandie, France & University of Cassino, Italy
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Researcher ID:
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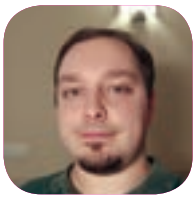

Dr. Alberto Anandon
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Pablo Olleros

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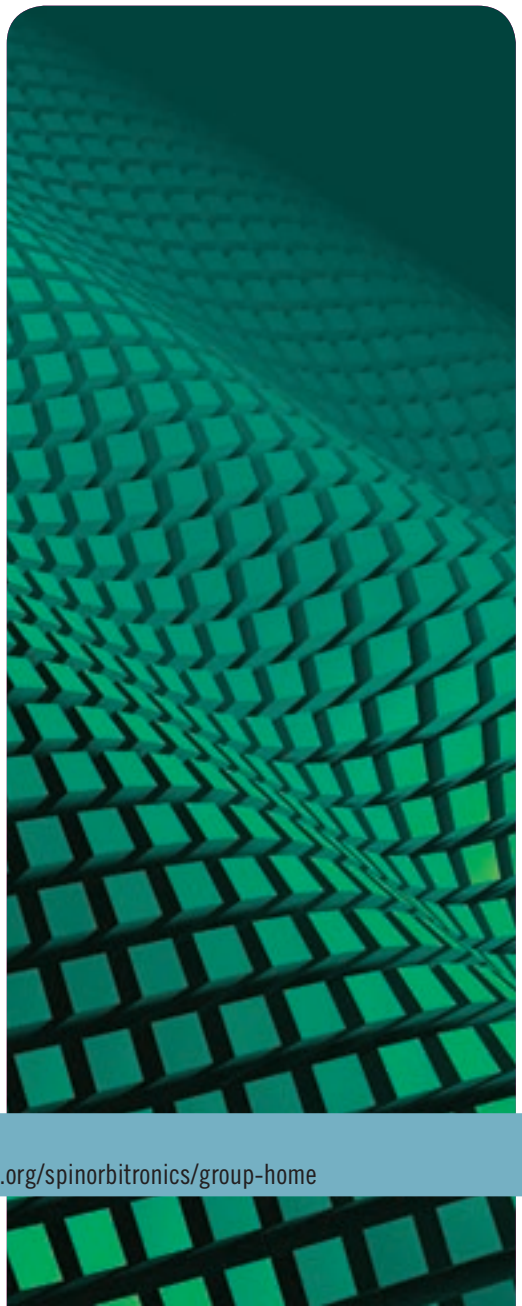
Sergio de las Heras



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

Research Lines

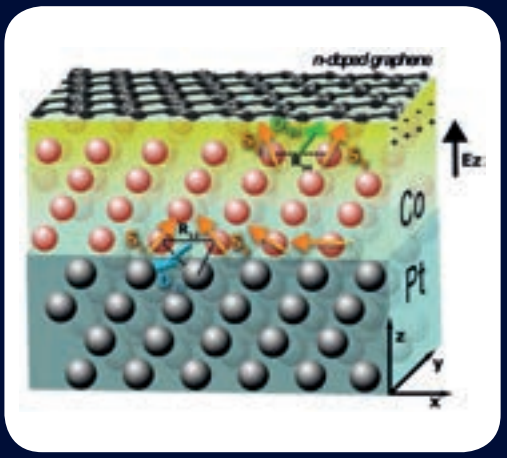
The group focuses the interests on solid-state physics and material science of low dimensional magnetic materials, covering epitaxial growth, surface/interface and magnetotransport characterization, as well as nanofabrication.

The main research lines of the group are:

1. **Spin-Orbitronics functional interfaces:** investigating the growth and the structural, surface and magneto-transport properties of heterostructures in which spin-orbit coupling plays an important role. These include thin films and multilayer stacks, combining ferromagnetic (FM) *Appl. Phys. Lett. 104 , 202407 (**2014**)*, antiferromagnetic (AFM) *Phys. Rev B, 92, 220422(R) (**2015**)*; *Phys. Rev. B, 86, 024421 (2012)*; perpendicular magnetic anisotropy (PMA) systems *J. Appl. Phys. 109, 07D357 (**2011**)* with antisymmetric Dzyaloshinskii-Moriya interaction (DMI) *Appl. Phys. Lett. 111, 202402 (**2017**)*, as well as molecules and graphene *Chem. Mater. 26, 2883 (**2014**)*; *Nano Lett. 16, 2 (**2016**)*. *Nano Lett., 18, 5364 (**2018**)*.

2. **Oxide-Spintronics:** engineering artificially the surface/interface of nanostructures based on perovskite oxides (which show a wide variety of properties as half-metallicity, dielectricity, ferroelectricity, multiferroicity), with the aim to tailor their spin-dependent transport characteristics and merge in a single device the functionalities of their individual constituents. *Adv. Funct. Mater.* **2017**, *1700664*; *Appl. Phys. Lett. 97, 152111 (**2010**) J. Appl. Phys. 110, 013919 (**2011**). New Journal of Physics 12, 103033 (**2010**)*.

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.*



highlight

Epitaxial Growth

GROUP LEADER

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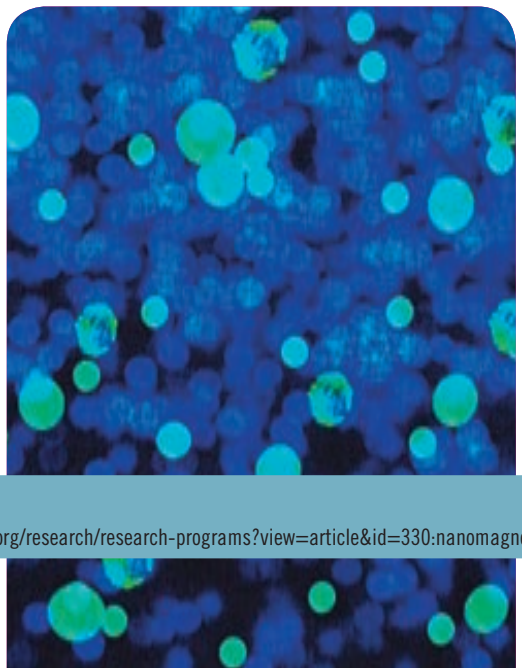
PhD STUDENT
Juan Carlos Martin

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.imdeananociencia.org/research/research-programs?view=article&id=330:nanomagnetism

In particular we carry out projects in:

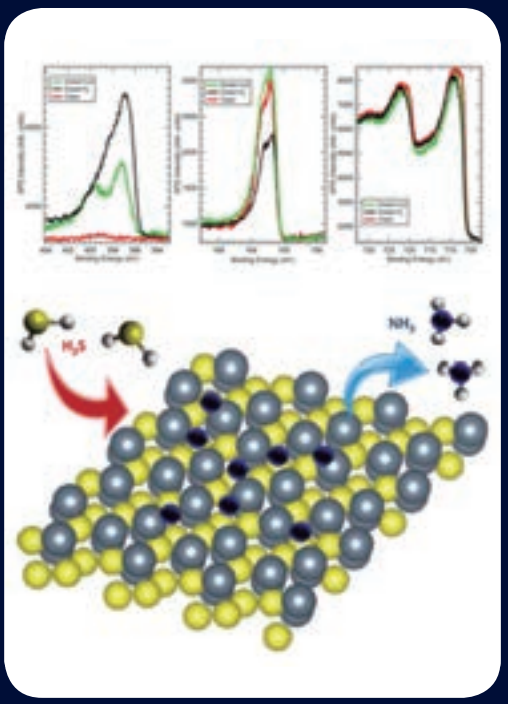
Surface reactivity: We investigate the role of different surfaces in the synthesis of organic molecules in prebiotic chemistry, as well as polymerization processes on metallic and oxide surfaces ("Reactivity of a FeS Surface under Room Temperature Exposure to Nitrogen and H2S" *Journal of Physical Chemistry 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 nonding 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*).

We have controlled the assembly of two diphenyl ethylene diamine enantiomers separately deposited on Cu(100). Using combined microscopy and synchrotron radiation spectroscopy we investigated the first stages of two-dimensional crystallization and the nucleation and growth of the second layer. We show that the chirality of enantiomers is expressed at different levels of molecular organization, a chiral square lattice aligned with the principal crystallographic directions of the substrate, and the intrinsic chirality of the molecules, only manifested through specific features contained within the corresponding unit cell. See: R. Palacios-Rivera, E. Barrena, J. Faraudo, P. Gargiani, M. A. Niño, D. Arvanitis, I. Kowalik, J. J. de Miguel, C. Ocal "Enantiopure Supramolecular Motifs of Self-Assembled Diamine-Based Chiral Molecules on Cu(100)" *Journal of Physical Chemistry C (**2018**), 122 pp.* 24129-24136.



highlight

Growth & Nanostructuring

GROUP LEADER

Prof. Feng Luo

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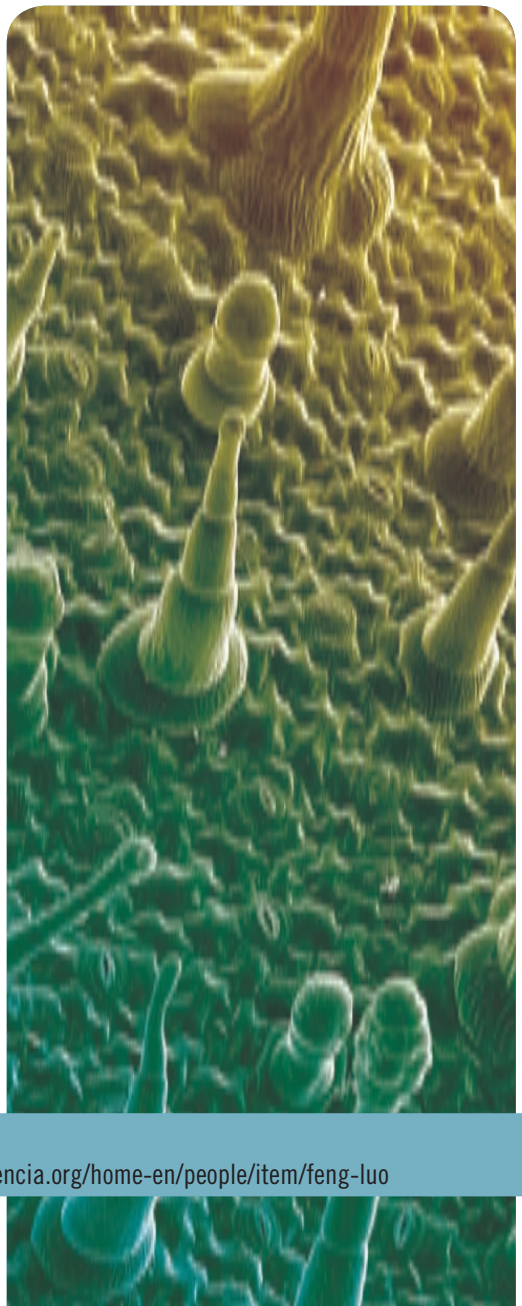


Group webpage:
http://www.imdeananociencia.org/home-en/people/item/feng-luo

Research Lines

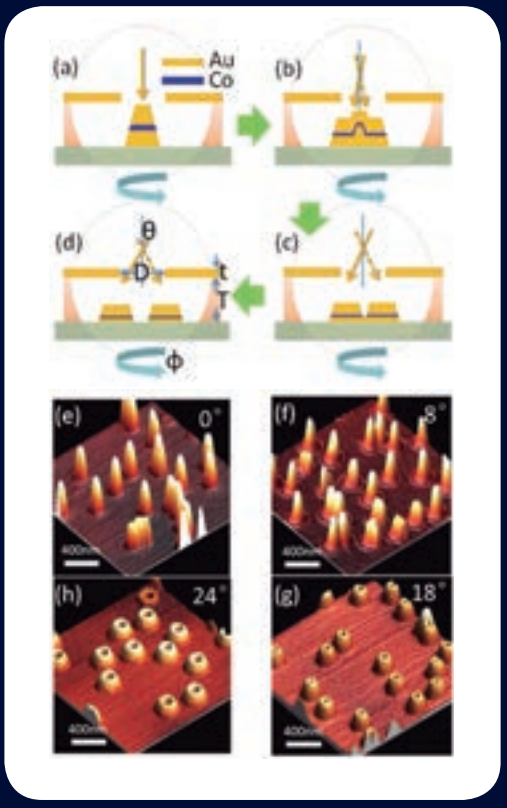
Our group has interests in three main research lines:

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 Pattering 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.

2. **Tuning Physical Properties by Design and Controlling: Interface Engineering at Atomic Scale and Lithography Patterning:** "Perpendicular magnetic anisotropy induced by tetragonal distortion of FeCo alloy films grown on Pd (001)",Phys. Rev. Lett., 96 (25), 257205 (2006); "Tuning the perpendicular magnetic anisotropy in tetragonally distorted $Fe_{1-x}Co_x$ alloy films on Rh (001) by varying the alloy composition", Appl. Phys. Lett., 91 (26), 262512 (2007); "Magnetoplasmonic Nanorings as Novel Architectures with Tunable Magneto-optical Activity in Wide Wavelength Ranges" Advanced Optical Materials, 2, 612 (2014).

3. **Advanced Characterization Techniques Based on X-ray and Electrons:** "Element-Specific Hysteresis Loop Measurements on Individual 35 nm Islands with Scanning Transmission X-Ray Microscopy", J. Nanosci. Nanotechnol.12, 2484 (2012); "Strongly enhanced orbital moment by reduced lattice symmetry and varying composition of $Fe_{1-x}Co_x$ alloy films", Phys. Rev. Lett., 100 (3), 037205 (2008); "Correlation between magnetic spin structure and the three-dimensional geometry in chemically synthesized nanoscale magnetite rings", Applied Physics Letters, 92 (22), 222508 (2008); "Active magnetoplasmonic split-ring/ring nanoantennas". Nanoscale 9, 37 (2016).

Morphology tuning of a series of Au/Co/Au nanostructures which gradually evolve from disk to ring allows controlling their optical and magneto-optical spectral responses in the visible and near infrared ranges. Bimodal resonant behavior in the optical and MO activity is observed, and by either tuning the morphological parameters, or the distribution of the ferromagnetic constituent, the spectral response of MO activity shows a good tunability and fine control, not only in a wide wavelength range, but also in the relative ratio of the Low-energy and High-energy modes, which has great potential in detailed design for telecommunication and sensor devices.



highlight

Rare-Earth free Permanent Magnets

GROUP LEADER

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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:

1. Growth of nanostructured magnetic thin films and multilayers (*APL Mater.* **2018**, *6*, 101109).
2. Innovative methods for the synthesis of ferromagnetic MnAl with PM properties by nanostructuring and phase transformation (*Acta Mater.* **2018**, *157*, 42), core results of the project "NEXMAG", coordinated by our group and awarded as Success Case by the M-ERA.NET Network (https://m-era.net/success-stories/new-exchange-coupled-manganese-based-magnetic-materials-nexmag).

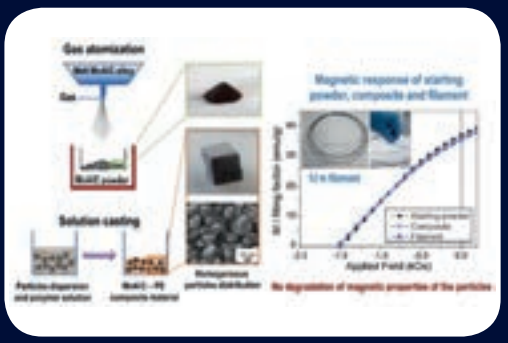
Group webpage:
http://nanociencia.imdea.org/division-permanent-magnets-applications

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.

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



highlight

Electrodeposited nanowires

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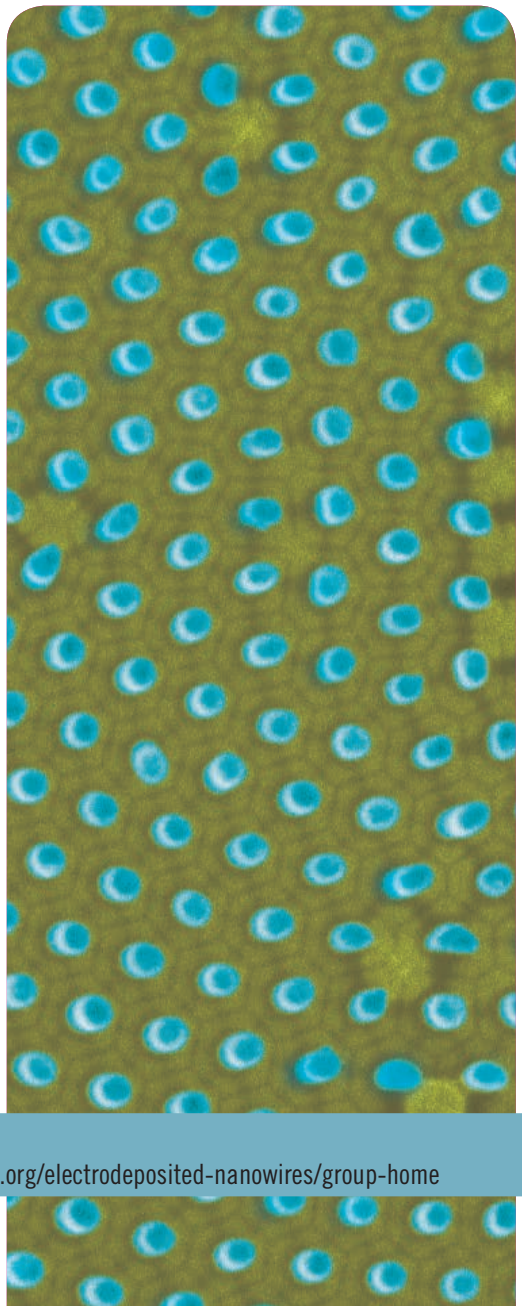


Group webpage:
http://nanociencia.imdea.org/electrodeposited-nanowires/group-home

Research Lines

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

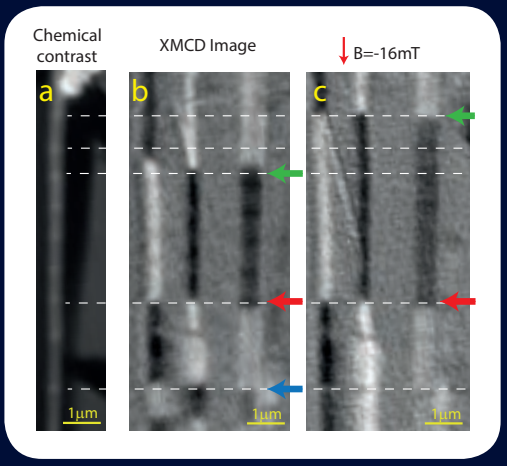
Domain wall spintronics. We study the domain wall structure and the magnetization processes of low dimensional systems – mainly cylindrical nanowires. We are interested in stabilizing domain walls in artificially created defects (*Sci. Rep. 8 (2018) 16695*) and in controlling the deppining of the different 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.

See: *Sci. Rep. 8 (2018) 16695*



highlight

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

Engineering Biofunctional Nanostructures
Dr. Aitziber L. Cortajarena

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

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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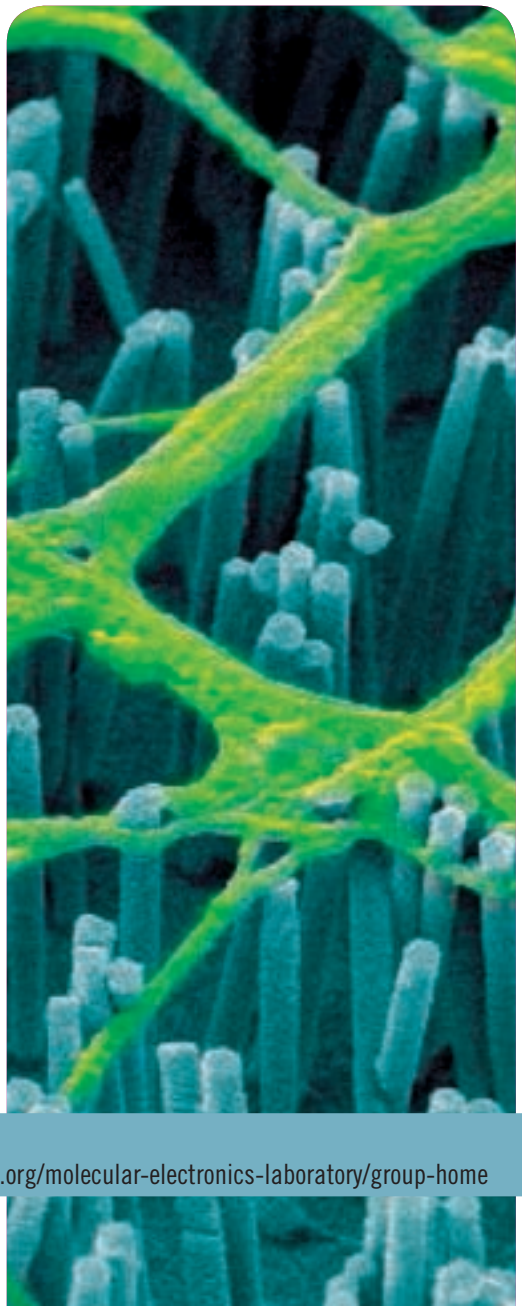


Group webpage:
http://nanociencia.imdea.org/molecular-electronics-laboratory/group-home

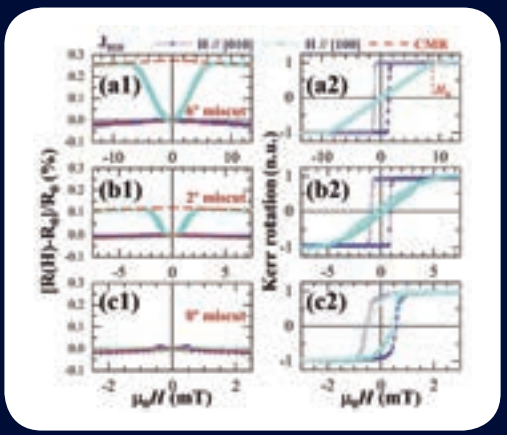
Research Lines

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 $La_{0.7}Sr_{0.3}MnO_3$ 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 manganitebased devices for the high-resolution low field magnetic sensors or spintronics. See: *Adv. Funct. Mater. 2017, 1700664*



highlight

Metallodrugs

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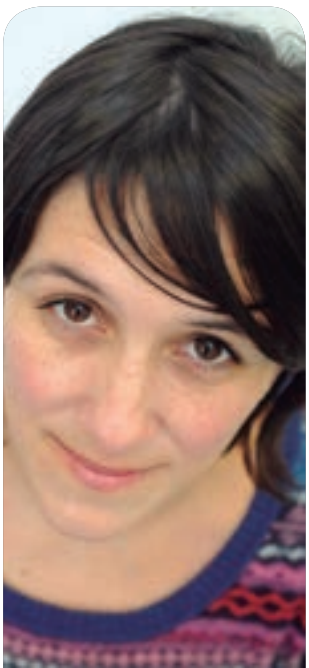


Group webpage:
http://nanociencia.imdea.org/metallodrugs-to-modulate-cancer-cell-machinery/group-home

Research Lines

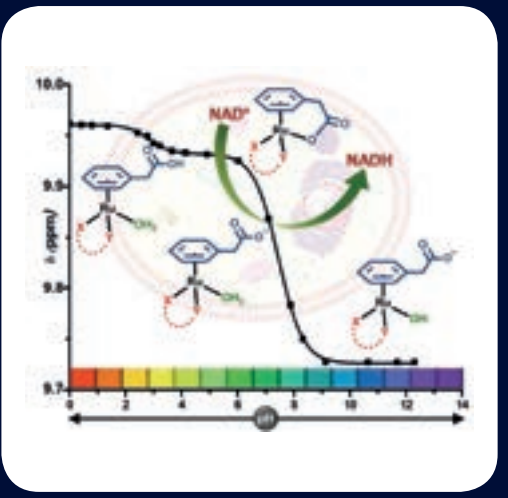
We exploit metal coordination and organometallic chemistry principles to design novel potent switchable metallodrugs, which allow us to modulate the cancerous cell machinery at the molecular level in a controlled manner.

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 Ru^{II}-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 Ru^{II}–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.



highlight

Hyperthermia

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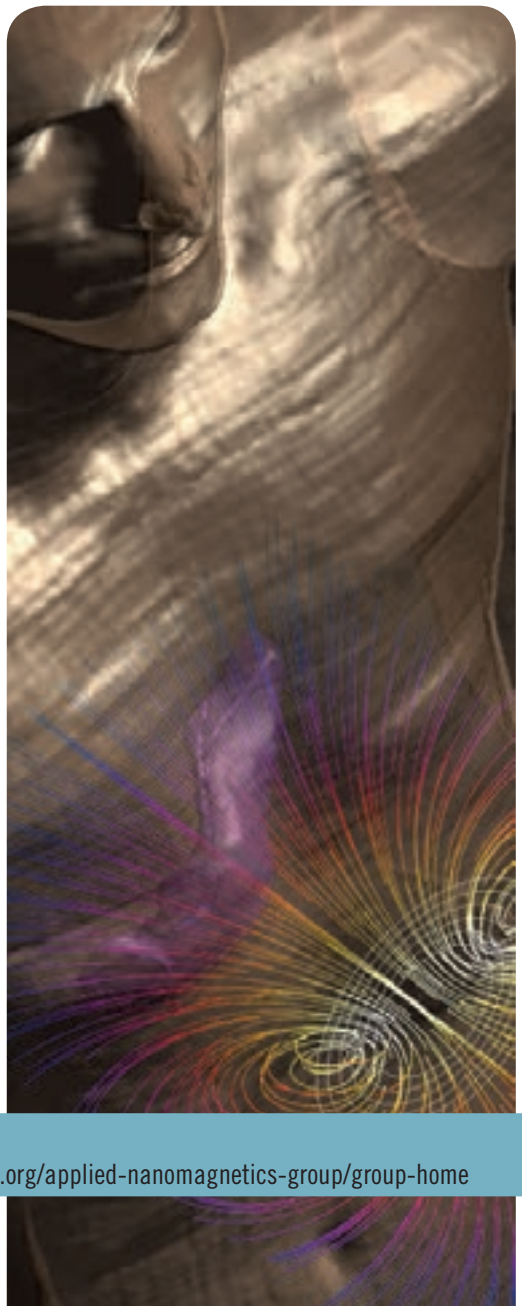


Group webpage:
http://nanociencia.imdea.org/applied-nanomagnetics-group/group-home

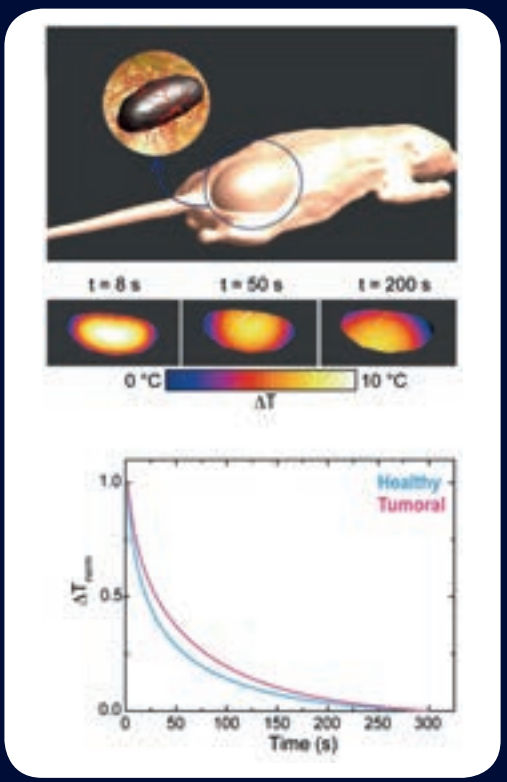
Research Lines

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 NANOLICO 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.



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Nucleic Acids and Nanoparticles in Nanomedicine

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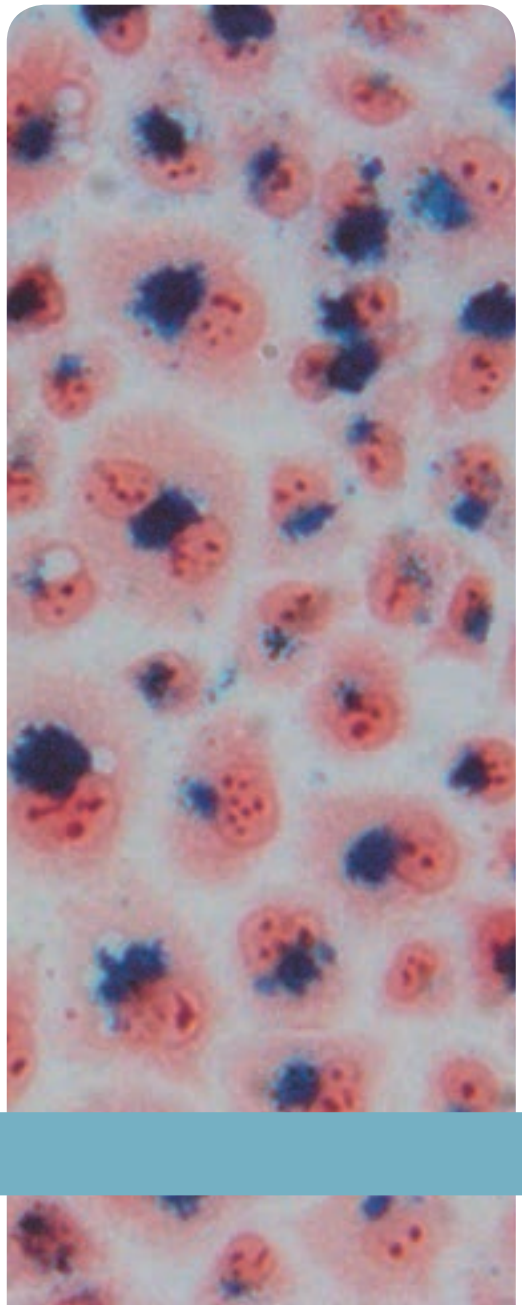


Group webpage:
www.nanobioimdea.com

Research Lines

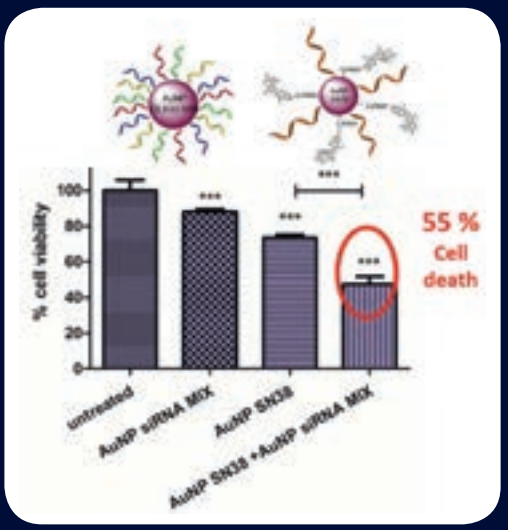
Our group is interested in novel approaches for the treatment and detection of diseases, particularly:

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



highlight

Engineering Biofunctional Nanostructures

GROUP LEADER

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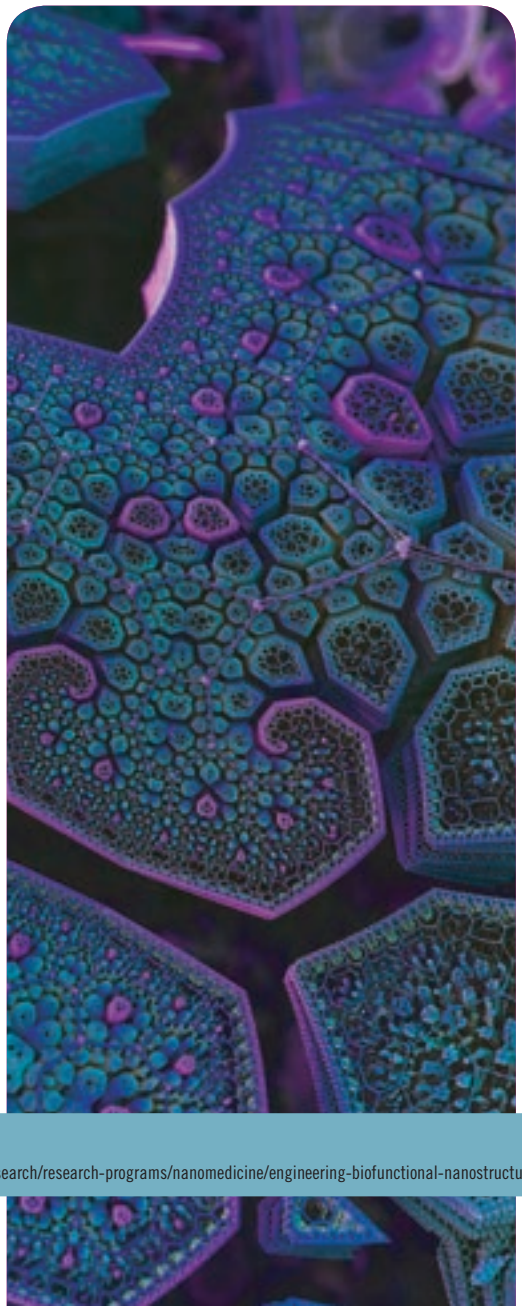


Group webpage:
http://www.nanociencia.imdea.org/research/research-programs/nanomedicine/engineering-biofunctional-nanostructures

Research Lines

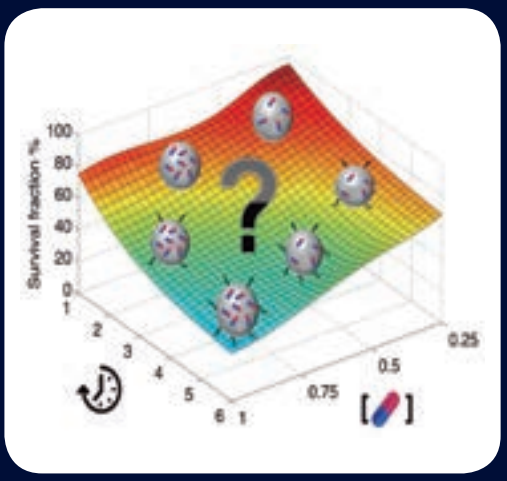
The group has varied interests at the interface of biochemistry, bioconjugation, functional materials and nanomedicine. The two main research lines of the group are:

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/acs.biomac.5b01147**; 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.

See: *Nanoscale*. **2017** 9(36):13760-13771.
(Link: *http://pubs.rsc.org/en/Content/ArticleLanding/2017/NR/C7NR04475E#!divAbstract*)



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Nanooncology

GROUP LEADER

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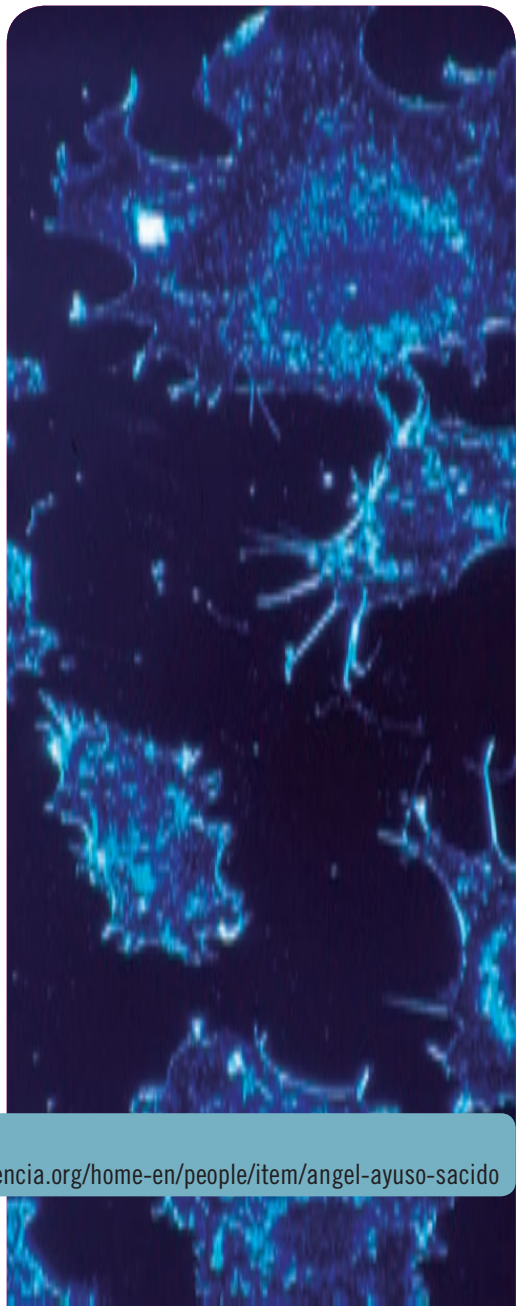

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Magnetic Nanoparticles In Biomedicine. Cell-Particle Interactions

GROUP LEADER

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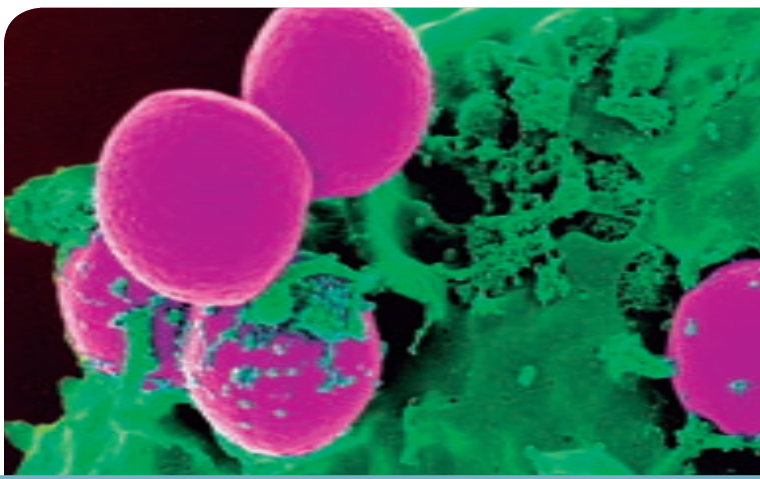
Research Lines

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



Group webpage:
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programme

Nanobiosystems

Programme Manager: **Prof. J.L. Carrascosa**

Research lines

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Prof. J.L. Carrascosa

Optical Nanomanipulation
Dr. Ricardo Arias-González

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. Víctor 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

GROUP LEADER

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Dr. Ana Cuervo

PhD STUDENT
Mar Pérez

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.

We have developed methods for correlative approaches in microscopy by combining transmission electron microscopy, light microscopy and X-ray microscopy. In particular, we have improved the acquisition process of soft-X ray microscopy images for tomographic reconstruction (José Javier Conesa, Joaquín Otón, Eva Pereiro, Francisco Javier Chichón and José L. Carrascosa. Near-Edge Absorption Soft X-ray Nanotomography of Cells Incubated with Nanoparticles. Proceedings of Microscopy & Microanalysis, 23, Issue S1, 992-993 (2017). doi: 10.1017/S1431927617005621), its application to the study of virus infected cells (Perez-Berna A.J., Valcarcel R., Rodríguez M.J., Chichon F.J., Sorrentino A., Carrascosa J.L., Gastaminza P. and Pereiro E. The Dual-axes for Soft X-Ray Cryo-tomography Reveals Ultrastructural Alterations of the Host Cell during Hepatitis C Infection by Increasing the Isotropic Axial Resolution Proceedings of Microscopy & Microanalysis. 23 (Suppl 1), doi:10.1017/S1431927617005542 (2017)), and the use of near-edge absorption X-ray spectroscopy to produce element-specific nanotomographic reconstruction of cells (José Javier

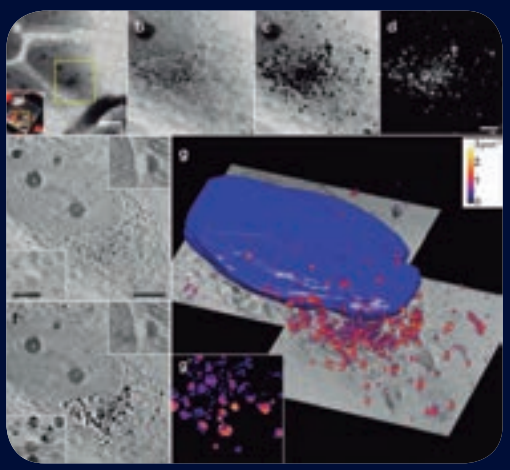
Group webpage:
http://macromolassemblies.wixsite.com/carrascosalab

Conesa, Joaquín Otón, Eva Pereiro, Francisco Javier Chichón and José L. Carrascosa. Near-Edge Absorption Soft X-ray Nanotomography of Cells Incubated with Nanoparticles. Proceedings of Microscopy & Microanalysis, 23, Issue S1, 992-993 (2017). doi: 10.1017/S1431927617005621).

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-Stubbs, 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).



highlight

Optical Nanomanipulation

GROUP LEADER

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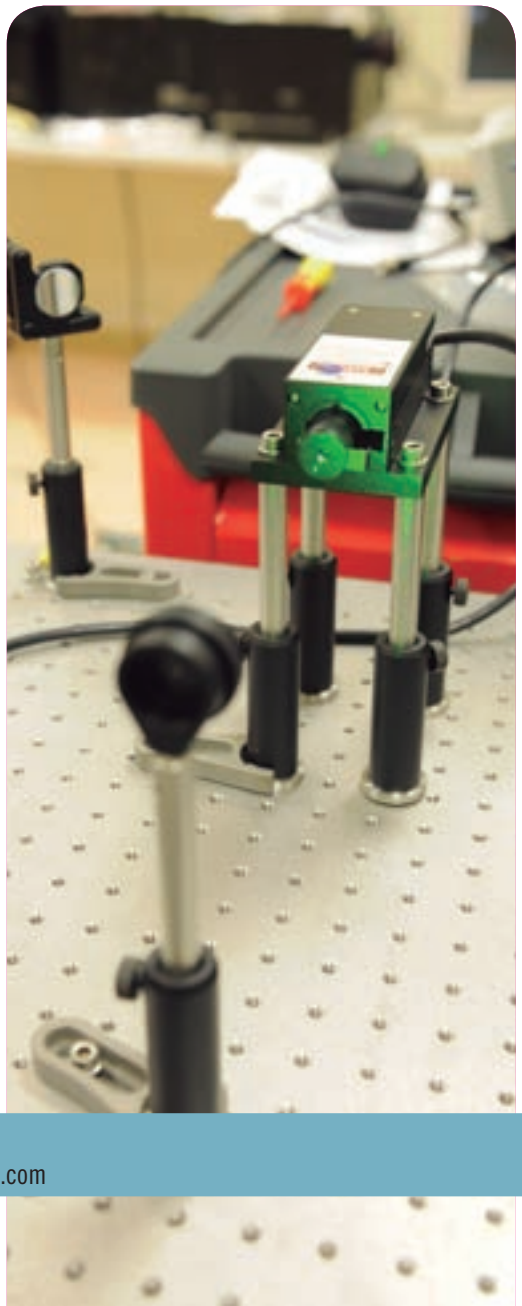
PhD STUDENTS

Irene Gutiérrez
Héctor Rodríguez-Rodríguez
(co-supervised by Dr. B.H. Juárez)
Vanesa González



Group webpage:
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Research Lines

We focus on Molecular Biophysics and biocompatible nano-systems, with a strong bond to both Mesoscopic Physics and Biological Chemistry. Current research lines:

- **Mechanochemistry of Nucleic Acids:** We study DNA and RNA repetitive sequences, which are able to self-fold into non-canonical structures and which are important in telomere end-protection, chromosome stability or in senescence as a barrier to tumorigenesis (*Sci. Rep.* **2017**, *7*, 11756).

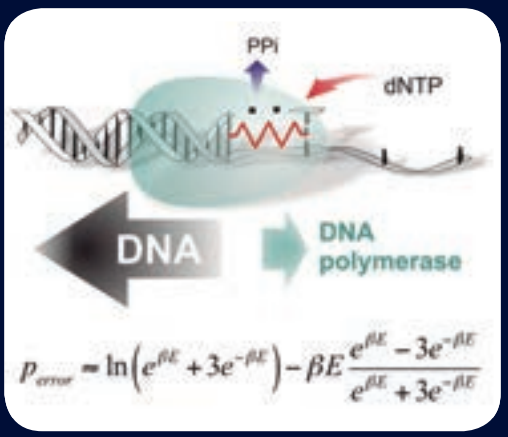
- **Thermodynamics of protein motors:** We study genetic information managing in replication and transcription as performed by polymerases, which are true molecular Maxwell's demons with a 2-bit nanoprocessor (*Sci. Rep.* **2017**, *7*, 7566, *Nucleic Acids Res.* **2017**, *45*, 7237).

- **Biocompatible nanoparticles with functional capacity:** Stringent control of stimulus-response phenomena in physiological media is demanded for tailoring biocompatible tools in nanomedicine and biosensor technology. We study quantum dots as sources of light for imaging purposes and magnetic and metallic nanoparticles as sources of heat for cancer therapies based on hyperthermia (*J. Phys. Chem. C* **2017**, *121*, 10124).

- **Non-equilibrium processes and Information:** Experimental research is the fundamental breeding ground for theory. The cell analyzed from the single-molecule perspective becomes a unique laboratory for the study of the so-called *Small Systems,* namely, those that exchange energy in quantities similar to those of the thermal fluctuations (*J. Chem. Phys.* **2017**, *147*, 205101).

Information management and thermodynamic efficiency of polymerase engines

The flexibility of the DNA double-helix polymer that results from replication is involved in the Brownian ratchet mechanism by which a DNA polymerase moves with a specific directionality and withstands high forces. This mechanochemistry has consequences for the maintenance of fidelity, which model by using Information Theory (*J. Chem. Phys.* **2016**, *145*, 185103). Our analysis allows the thermodynamic efficiency of these information biomachines to be understood, quantified and compared with those of macroscopic machines (*Sci. Rep.* **2017**, *7*, *7566*).



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Advanced Fluorescence Nanoscopy

GROUP LEADER

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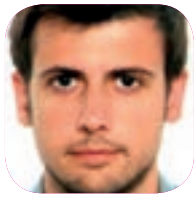

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Dr. Caterina Tone
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PhD STUDENTS

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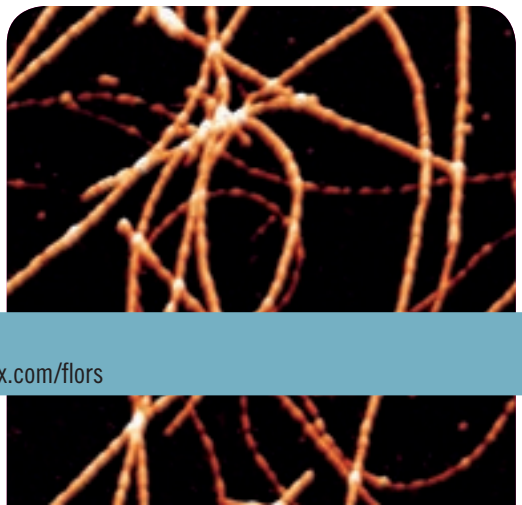
Adrián del Valle



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

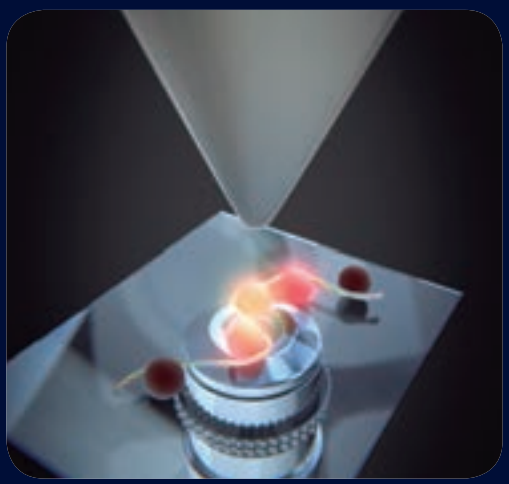
Research Lines

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).

The combination of complementary techniques to characterize materials at the nanoscale is crucial to gain a more complete picture of their structure, a key step to design and fabricate new materials with improved properties and diverse functions. Correlative atomic force microscopy and localization-based super-resolution microscopy is a useful tool that provides insight into the structure and emissive properties of fluorescent β-lactoglobulin (βLG) amyloid-like fibrils. These hybrid materials were made by functionalization of βLG with organic fluorophores and quantum dots. Simultaneous labelling of βLG fibers by QD655 and QD525 allowed us to achieve correlative AFM and two-color super-resolution fluorescence imaging of these hybrid materials. These experiments allow combining information about the topography and number of filaments that compose a fibril, as well as the emissive properties and nanoscale spatial distribution of the attached fluorophores. This study represents an important step forward in the characterization of multi-functionalized hybrid materials, a key challenge in nanoscience. *Small* **2017**, *13*, 1603784.



highlight

Protein Engineering

GROUP LEADER

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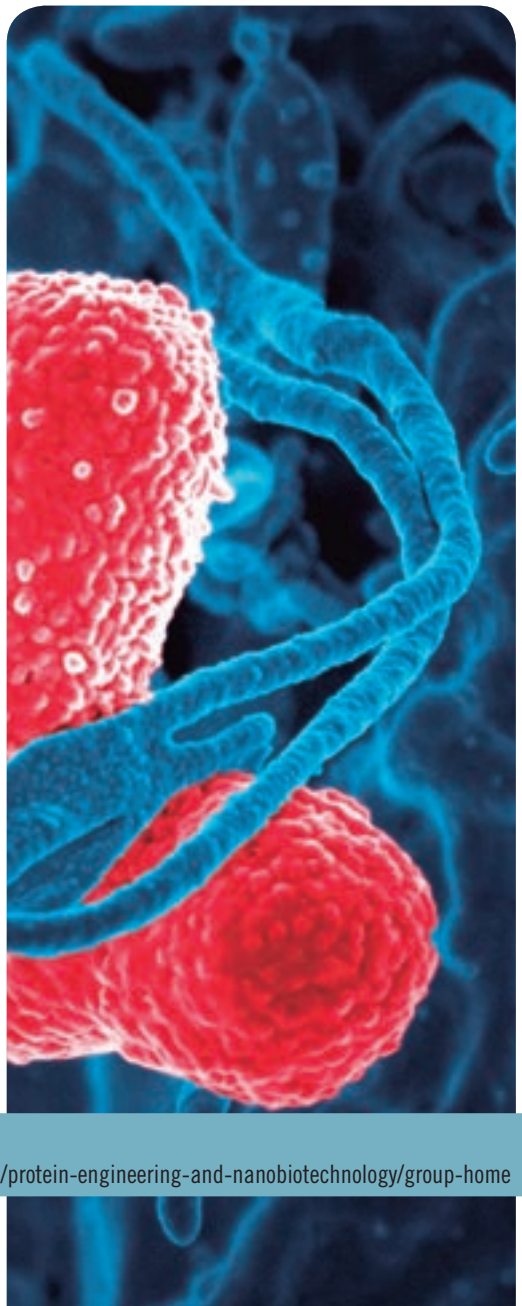


Group webpage:
www.nanociencia.imdea.org/protein-engineering-and-nanobiotechnology/group-home

Research Lines

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

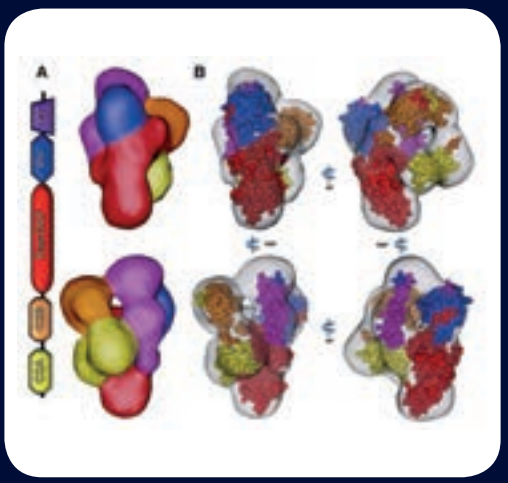
Specifically, the current research topics are:

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 *Biol Chem.* **2017**;*399: 63.* doi: 10.1515/hsz-2017-0159.



highlight

Molecular Motors Nanomanipulation Lab

GROUP LEADER

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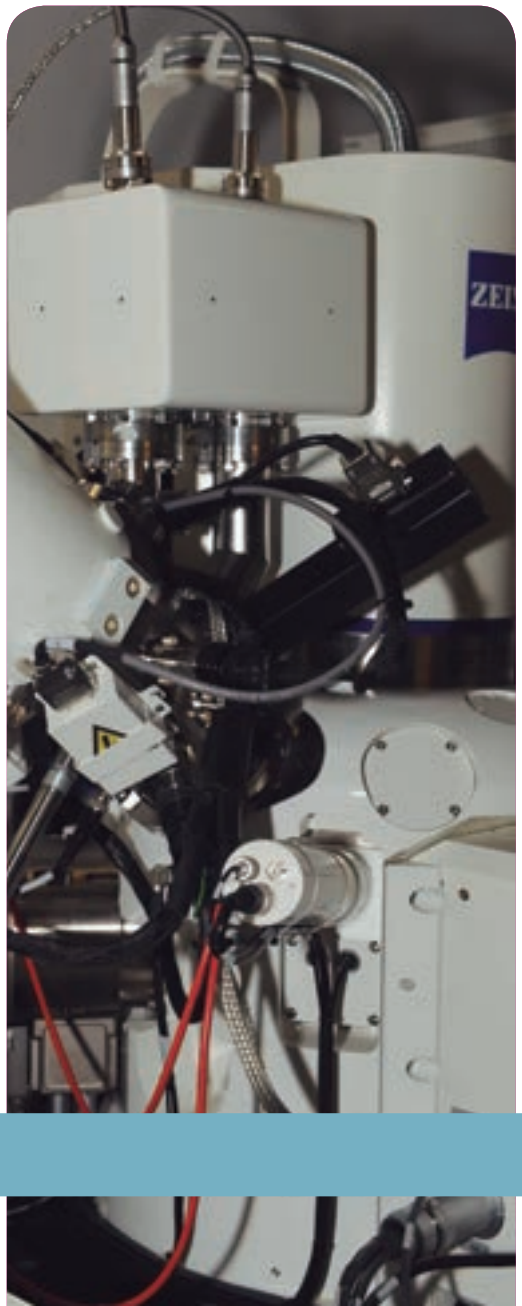
Katerina M. Lemishko
Carlos Rodriguez



Group webpage:
www.borjaibarralab.com

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 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:

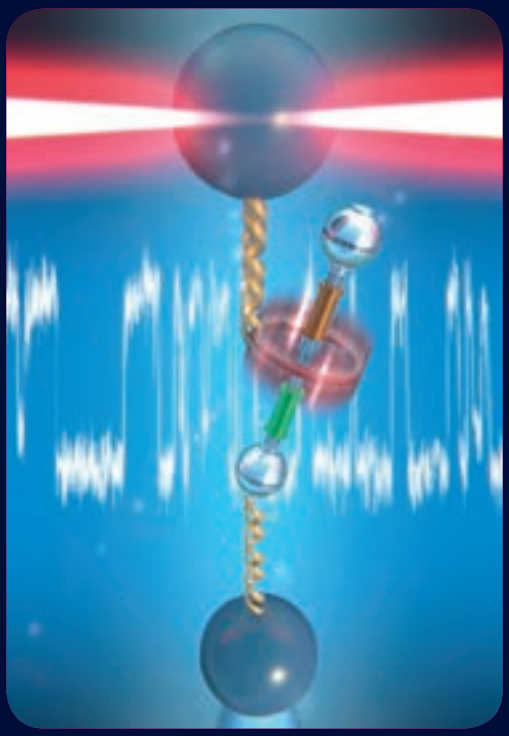
1. **Biological machinery involved in nucleic acids metabolism.** Replication and transcription of DNA are fundamental for life. We are measuring the operational dynamics of the biological machinery involved in: i) mitochondrial DNA replication *(NAR 2017; PLoS One 2017; JSAT 2016)* and ii) transcription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

Dynamics of individual molecular shuttles. Molecular shuttles are the basis of advanced synthetic molecular machines. In these devices a macrocycle threaded onto a linear component shuttles between different portions of the thread in response to external stimuli. We used optical tweezers to measure thousands of individual shuttling events and determined the force-dependent kinetic rates of the macrocycle motion and the main parameters governing the energy landscape of the system in aqueous conditions. Our findings could open avenues for the real-time characterization of synthetic devices at the single molecule level, and provide crucial information for designing molecular machinery able to operate under physiological conditions. *Nature Communications,* **9**, *4512, (2018).*



highlight

Protein Biophysics

GROUP LEADER

Prof. Víctor Muñoz

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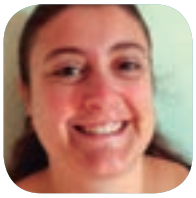

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TECHNICIAN

Mar Pulido

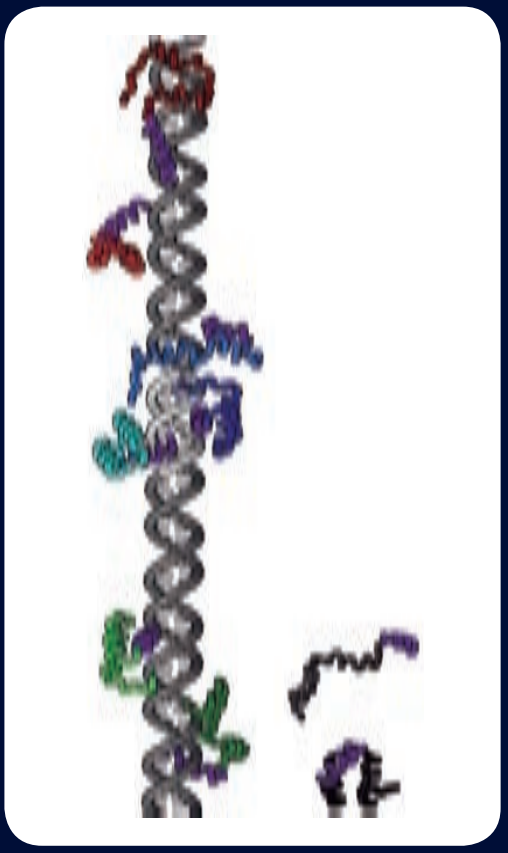
Group webpage:
http://www.nanoscience.imdea.org/home-en/people/item/victor-munoz

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.



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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

Functional Surfaces

GROUP LEADER

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Dr. Ivan Navarro-Baena
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Dr. Jean Philippe Cacheux
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María Teresa Alameda
Alejandra Jacobo
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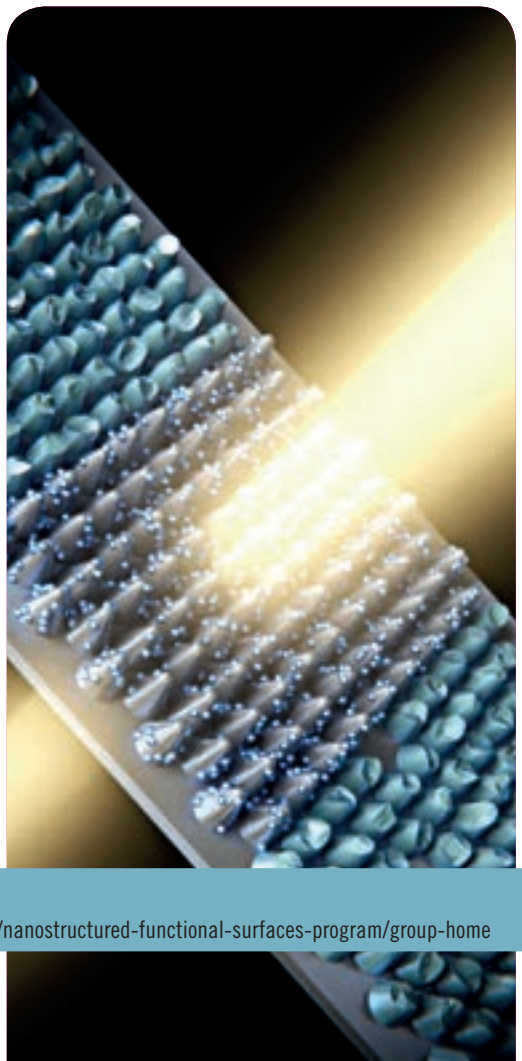


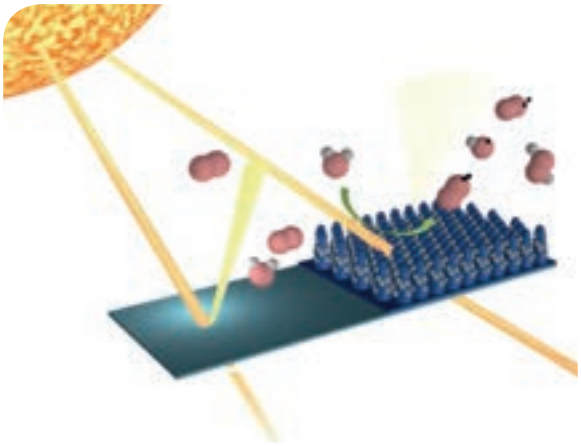
Group webpage:
http://nanociencia.imdea.org/nanostructured-functional-surfaces-program/group-home

Research Lines

1. Nano-engineered functional surfaces for medical applications, particularly the development of biomimetic bactericidal functionalities *(Bioinspir Biomim* **2018**, *13,*026011*)* and cell culture platforms for cell biomechanical assays *(Adv. Funct. Mater.* **2016**, *26,* 5599*)*.

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.

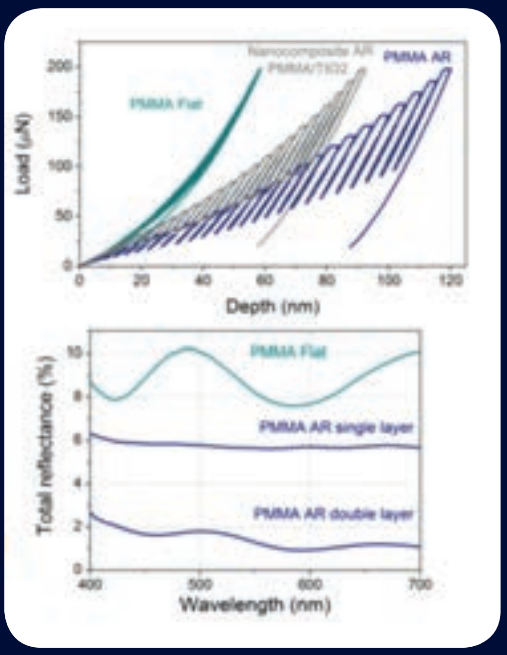
3. Polymer nanoimprinting for optical applications such as polymer lasers and waveguides, antireflective surfaces (*Nanoscale,* **2018**, *10,* 15496) and optical sensors in collaboration with the Organic Photophysics and Photonics group.



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).



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Quantum Devices and Photonics

GROUP LEADER

Prof. Daniel Granados

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Scopus Author ID:
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Dr. Jorge Trasobares
National University of Singapore

PhD STUDENTS
Fernando Jiménez
Victor Marzoa
Marina Calero
(co-supervised with Prof. Vicent)

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

Group webpage:
http://www.nanoscience.imdea.org/quantum-nanodevices/group-home

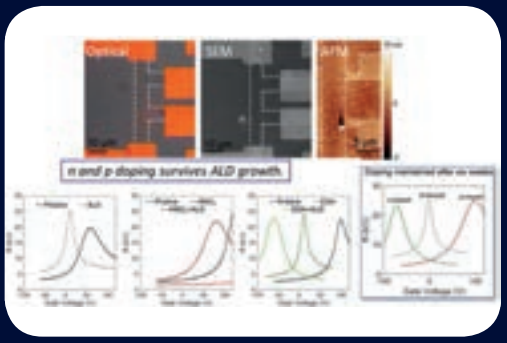
focused on the study and exploitation of the intrinsic properties of 2D materials, very limited work has been devoted to the engineering of their intrinsic properties. The "all-surface" nature of these materials makes device fabrication complex, and so far only the most conventional micro and nanofabrication 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 Al_2O_3 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).



highlight

Transport in 2D Systems

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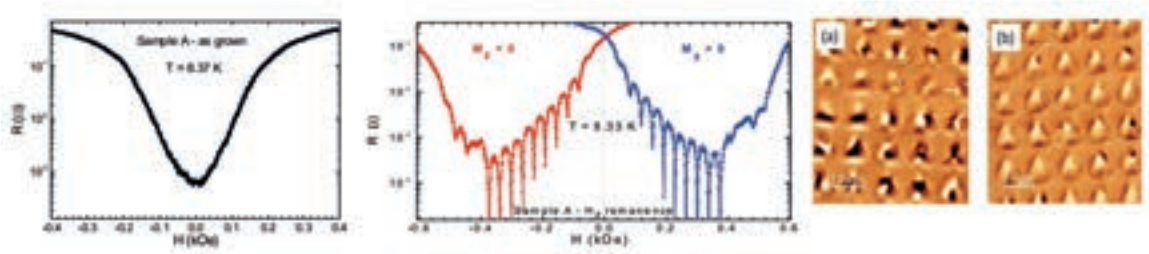
Research Lines

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.

highlight

2D Materials

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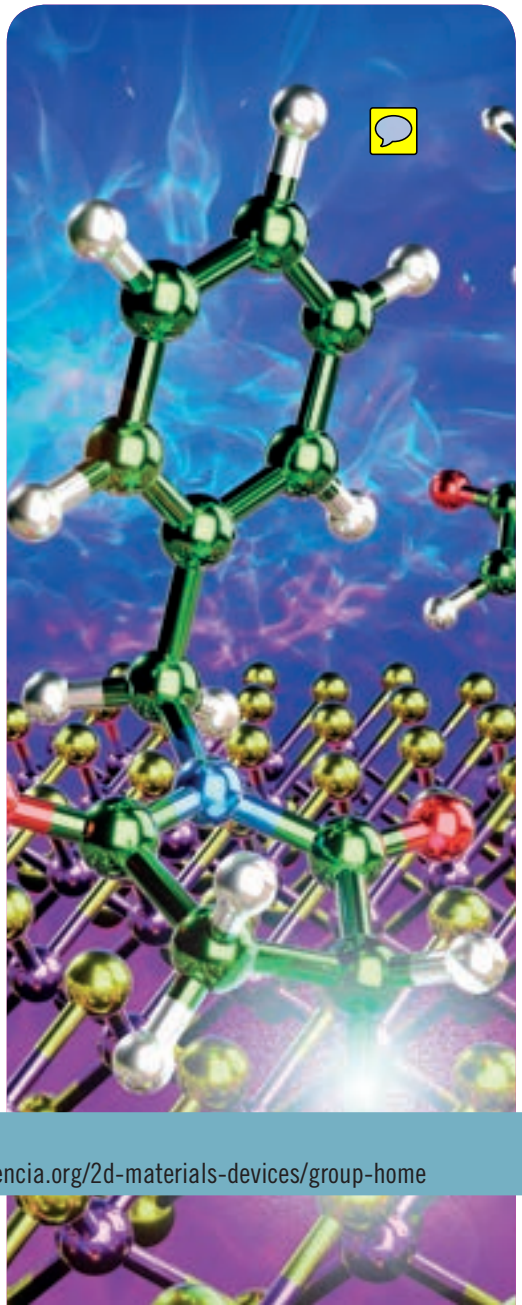

Group webpage:
http://www.imdeananociencia.org/2d-materials-devices/group-home

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)*.

highlight

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PhD: Cambridge University, UK

Dr. Vanessa Rodríguez
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Mr. Óscar Bodas
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3

scientific report

annual report 2018

1. Publications, contributions to books and patents

1.1. Publications

1. **Spontaneous exchange bias formation driven by a structural phase transition in the antiferromagnetic material.** Migliorini, A., Kuerbanjiang, B., Huminiuc, T., Kepaptsoglou, D., Muñoz, M., Cuñado, J.L.F., Camarero, J., Aroca, C., Vallejo-Fernández, G., Lazarov, V.K., Prieto, J.L. (2018) *Nature Materials*, **17** (1), pp. 28-34. DOI: 10.1038/NMAT5030

2. **Gas-Phase Functionalization of Macroscopic Carbon Nanotube Fiber Assemblies: Reaction Control, Electrochemical Properties, and Use for Flexible Supercapacitors.** Iglesias D., Senokos E., Alemán B., Cabana L., Navío C., Marcilla R., Prato M., Vilatela J.J., Marchesan S. (2018). *ACS Appl. Mater. Interfaces*, 2018, **10** (6), pp 5760–5770. DOI: 10.1021/acsami.7b15973

3. **Neon diffraction from graphene on Ru(0001).** Anemone, G., Al Taleb, A., Miranda, R., Farías, D. (2018) Surface Science. DOI: 10.1016/j.susc.2018.02.017

4. **Concurrent Optical Gain Optimization and Electrical Tuning in Novel Oligomer:Polymer Blends with Yellow-Green Laser Emission.** Zhang, Q., Wei, Q., Guo, X., Hai, G., Sun, H., Li, J., Xia, R., Qian, Y., Casado, S., Castro-Smirnov, J.R., Cabanillas-Gonzalez, J. (2018) *Advanced Science*, art. no. **1801455**. DOI: 10.1002/advs.201801455. **Open Access**

5. **High-temperature air-stable solar selective coating based on $MoSi_2$–Si_3N_4 composite.** Rodríguez-Palomo, A., Céspedes, E., Hernández-Pinilla, D., Prieto, C. (2018) *Solar Energy Materials and Solar Cells*, **174**, pp. 50-55. DOI: 10.1016/j.solmat.2017.08.021

6. **Selective G-quadruplex binding by oligoarginine-Ru(dppz) metallopeptides.** Bouzada, D., Salvadó, I., Barka, G., Rama, G., Martínez-Costas, J., Lorca, R., Somoza, Á., Melle-Franco, M., Vázquez, M.E., López, M.V. (2018) Chemical Communications, **54** (6), pp. 658-661. DOI: 10.1039/c7cc08286j

7. **The cohesin module is a major determinant of cellulosome mechanical stability.** Galera-Prat, A., Moraïs, S., Vazana, Y., Bayer, E.A., Carrión-Vázquez, M. (2018) *Journal of Biological Chemistry,* **293** (19), pp. 7139-7147. DOI: 10.1074/jbc.RA117.000644. **Open Access**

8. **Designing high performance all-small-molecule solar cells with non-fullerene acceptors: Comprehensive studies on photoexcitation dynamics and charge separation kinetics.** Shi, J., Isakova, A., Abudulimu, A., Van Den Berg, M., Kwon, O.K., Meixner, A.J., Park, S.Y., Zhang, D., Gierschner, J., Lüer, L. (2018) *Energy and Environmental Science*, **11** (1), pp. 211-220. DOI: 10.1039/c7ee02967e

9. **A giant M_2L_3 metallo-organic helicate based on phthalocyanines as a host for electroactive molecules.** Fazio, E., Haynes, C.J.E., De La Torre, G., Nitschke, J.R., Torres, T. (2018) *Chemical Communications*, **54** (21), pp. 2651-2654. DOI: 10.1039/c7cc09528g

10. **Improving charge injection and charge transport in CuO-based p-type DSSCs-a quick and simple precipitation method for small CuO nanoparticles.** Langmar, O., Ganivet, C.R., Schol, P., Scharl, T., De La Torre, G., Torres, T., Costa, R.D., Guldi, D.M. (2018) *Journal of Materials Chemistry* C, **6** (19), pp. 5176-5180. DOI: 10.1039/c8tc00769a

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12. **On the regioselectivity of the Diels-Alder cycloaddition to C60in high spin states.** El Bakouri, O., Garcia-Borràs, M., Girón, R.M., Filippone, S., Martín, N., Solà, M. (2018) *Physical Chemistry Chemical Physics,* **20** (17), pp. 11577-11585. DOI: 10.1039/c7cp07965f. Open Access

13. **From isodesmic to highly cooperative: Reverting the supramolecular polymerization mechanism in water by fine monomer design.** Casellas, N.M., Pujals, S., Bochicchio, D., Pavan, G.M., Torres, T., Albertazzi, L., García-Iglesias, M. (2018) *Chemical Communications,* **54** (33), pp. 4112-4115. DOI: 10.1039/c8cc01259h

14. **Simple bond patterns predict the stability of Diels-Alder adducts of empty fullerenes.** Pla, P., Wang, Y., Alcamí, M. (2018) *Chemical Communications,* **54** (33), pp. 4156-4159. DOI: 10.1039/c8cc01709c

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16. **Reversible dispersion and release of carbon nanotubes: Via cooperative clamping interactions with hydrogen-bonded nanorings.** Chamorro, R., De Juan-Fernández, L., Nieto-Ortega, B., Mayoral, M.J., Casado, S., Ruiz-González, L., Pérez, E.M., González-Rodríguez, D. (2018) *Chemical Science,* **9** (17), pp. 4176-4184. DOI: 10.1039/c8sc00843d. **Open Access**

17. **Nano-engineering safer-by-design nanoparticle based moth-eye mimetic bactericidal and cytocompatible polymer surfaces.** Viela, F., Navarro-Baena, I., Jacobo-Martín, A., Hernández, J.J., Boyano-Escalera, M., Osorio, M.R., Rodríguez, I. (2018) *RSC Advances,* **8** (40), pp. 22606-22616. DOI: 10.1039/c8ra03403f. **Open Access**

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20. **Transparency revealed.** Miranda, R. (2018) *Nature Materials* **17**, 952-953. DOI: 10.1038/s41563-018-0201-7

21. **Amplified spontaneous emission in insulated polythiophenes**. Sun, C., Mróz, M.M., Castro Smirnov, J.R., Lüer, L., Hermida-Merino, D., Zhao, C., Takeuchi, M., Sugiyasu, K., Cabanillas-González, J. (2018) *Journal of Materials Chemistry C*, **6** (24), pp. 6591-6596. DOI: 10.1039/c8tc01204k

22. **Study of the electronic structure of electron accepting cyano-films: TCNQ: Versus TCNE.** Capitán, M.J., Álvarez, J., Navio, C. (2018) *Physical Chemistry Chemical Physics,* **20** (15), pp. 10450-10459. DOI: 10.1039/c7cp07963j. **Open Access**

23. **Uracil grafted imine-based covalent organic framework for nucleobase recognition.** Royuela, S., García-Garrido, E., Martín Arroyo, M., Mancheño, M.J., Ramos, M.M., González-Rodríguez, D., Somoza, Á., Zamora, F., Segura, J.L. (2018) *Chemical Communications,* **54** (63), pp. 8729-8732. DOI: 10.1039/c8cc04346a

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27. **Toward Air Stability of Thin GaSe Devices: Avoiding Environmental and Laser-Induced Degradation by Encapsulation.** Zhao, Q., Frisenda, R., Gant, P., Perez de Lara, D., Munuera, C., Garcia-Hernandez, M., Niu, Y., Wang, T., Jie, W., Castellanos-Gomez, A. (2018) *Advanced Functional Materials,* art. No. 1805304. DOI: 10.1002/adfm.201805304

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30. **In Vivo Contactless Brain Nanothermometry.** Del Rosal, B., Ruiz, D., Chaves-Coira, I., Juárez, B.H., Monge, L., Hong, G., Fernández, N., Jaque, D. (2018) *Advanced Functional Materials,* art. No. 1806088. DOI: 10.1002/adfm.201806088

31. **Chemical vapor deposition growth of boron-carbon-nitrogen layers from methylamine borane thermolysis products.** Leardini, F., Flores, E., Galvis, A.R.E., Ferrer, I.J., Ares, J.R., Sánchez, C., Molina, P., Van Der Meulen, H.P., Navarro, C.G., Polin, G.L., Urbanos, F.J., Granados, D., Garćıa-Garćıa, F.J., Demirci, U.B., Yot, P.G., Mastrangelo, F., Betti, M.G., Mariani, C. (2018) *Nanotechnology,* **29** (2), art. No. 025603. DOI: 10.1088/1361-6528/aa9c07. **Open Access**

32. **Ultrastable Supramolecular Self-Encapsulated Wide-Bandgap Conjugated Polymers for Large-Area and Flexible Electroluminescent Devices.** Lin, J., Liu, B., Yu, M., Wang, X., Lin, Z., Zhang, X., Sun, C., Cabanillas-Gonzalez, J., Xie, L., Liu, F., Ou, C., Bai, L., Han, Y., Xu, M., Zhu, W., Smith, T.A., Stavrinou, P.N., Bradley, D.D.C., Huang, W. (2018) *Advanced Materials*, art. No. 1804811. DOI: 10.1002/adma.201804811

33. **Recent progress in the assembly of nanodevices and van der Waals heterostructures by deterministic placement of 2D materials.** Frisenda, R., Navarro-Moratalla, E., Gant, P., Pérez De Lara, D., Jarillo-Herrero, P., Gorbachev, R.V., Castellanos-Gomez, A. (2018) *Chemical Society Reviews,* Vol. **47**, Issue 1, pp. 53-68. DOI: 10.1039/c7cs00556c

34. **Recent Progress on Antimonene: A New Bidimensional Material.** Ares, P., Palacios, J.J., Abellán, G., Gómez-Herrero, J., Zamora, F. (2018) *Advanced Materials,* **30** (2), art. no. 1703771. DOI: 10.1002/adma.201703771

35. **Edge Modes and Nonlocal Conductance in Graphene Superlattices.** Brown, R., Walet, N.R., Guinea, F. (2018) *Physical Review Letters,* **120** (2), art. No. 026802. DOI: 10.1103/PhysRevLett.120.026802

36. **Reactivity of a FeS Surface under Room Temperature Exposure to Nitrogen and H_2S.** Niño, M.A., Flores, E., Sánchez, C., Rojo, J.M. (2018) *Journal of Physical Chemistry B,* **122** (2), pp. 705-712. DOI: 10.1021/acs.jpcb.7b06309

37. **Exploring Tetrathiafulvalene–Carbon Nanodot Conjugates in Charge Transfer Reactions.** Ferrer-Ruiz, A., Scharl, T., Haines, P., Rodríguez-Pérez, L., Cadranel, A., Herranz, M.Á., Guldi, D.M., Martín, N. (2018) *Angewandte Chemie - International Edition,* **57** (4), pp. 1001-1005.DOI: 10.1002/anie.201709561

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39. **Light-Harvesting Fluorescent Supramolecular Block Copolymers Based on Cyanostilbene Derivatives and Cucurbit[8]urils in Aqueous Solution.** Kim, H.-J., Nandajan, P.C., Gierschner, J., Park, S.Y. (2018) *Advanced Functional Materials,* **28** (4), art. No. 1705141. DOI: 10.1002/adfm.201705141

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41. **Reversible Thermochromic Polymeric Thin Films Made of Ultrathin 2D Crystals of Coordination Polymers Based on Copper(I)-Thiophenolates.** Troyano, J., Castillo, O., Martínez, J.I., Fernández-Moreira, V., Ballesteros, Y., Maspoch, D., Zamora, F., Delgado, S. (2018) *Advanced Functional Materials,* **28** (5), art. No. 1704040. DOI: 10.1002/adfm.201704040

42. **Self-assembly of repeat proteins: Concepts and design of new interfaces.** Sanchez-de Alcazar, D., Mejias, S.H., Erazo, K., Sot, B., Cortajarena, A.L. (2018) *Journal of Structural Biology,* **201** (2), pp. 118-129. DOI: 10.1016/j.jsb.2017.09.002

43. **Amplified spontaneous emission in action: Sub-ppm optical detection of acid vapors in poly[2-methoxy-5-(2-ethylhexyloxy)-1,4-phenylenevinylene] thin films.** Guillén, M.G., Gámez, F., Lopes-Costa, T., Castro-Smirnov, J.R., Wannemacher, R., Cabanillas-González, J., Pedrosa, J.M. (2018) *Sensors and Actuators, B: Chemical,* **255**, pp. 1354-1361. DOI: 10.1016/j.snb.2017.08.136

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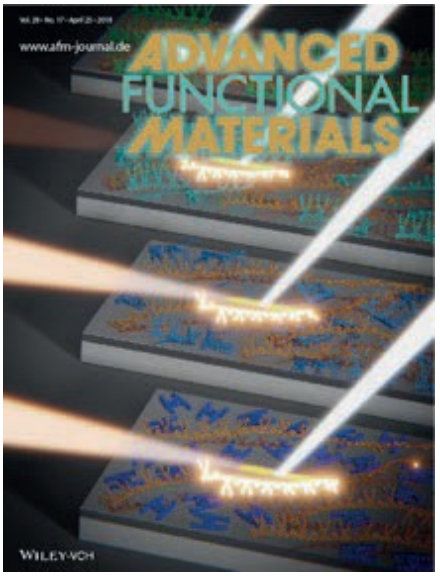

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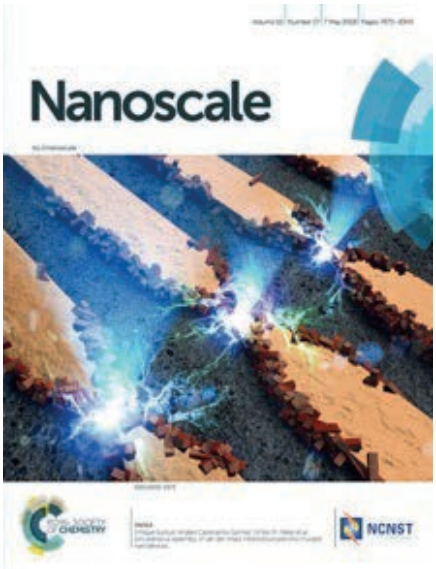

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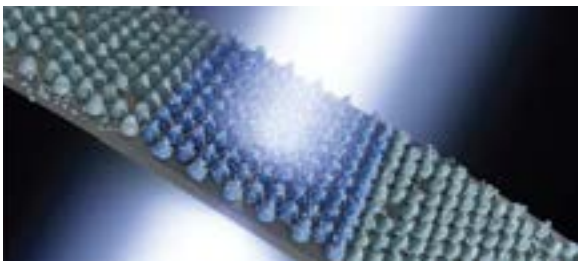

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181. **Electrochemically driven phenothiazine modification of carbon nanodots.** Mediavilla, M., Martínez-Periñán, E., Bravo, I., García-Mendiola, T., Revenga-Parra, M., Pariente, F., Lorenzo, E. (2018) *Nano Research,* **11** (12), pp. 6405-6416. DOI: 10.1007/s12274-018-2165-y

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183. **Observation of a topologically protected state in a magnetic domain wall stabilized by a ferromagnetic chemical barrier.** Ruiz-Gómez, S., Foerster, M., Aballe, L., Proenca, M.P., Lucas, I., Prieto, J.L., Mascaraque, A., de la Figuera, J., Quesada, A., Pérez, L. (2018) *Scientific Reports,* **8** (1), art. No. 16695. DOI: 10.1038/s41598-018-35039-6. **Open Access**

184. **Development of permanent magnet MnAlC/polymer composites and flexible filament for bonding and 3D-printing technologies.** Palmero, E.M., Rial, J., de Vicente, J., Camarero, J., Skårman, B., Vidarsson, H., Larsson, P.-O., Bollero, A. (2018) *Science and Technology of Advanced Materials,* **19** (1), pp. 465-473. DOI: 10.1080/14686996.2018.1471321. **Open Access**

185. **Attosecond spectroscopy of bio-chemically relevant molecules.** F. Calegari, A. Trabattoni, E. Månsson, J. B. Greenwood, P. Decleva, F. Martìn, M. Nisoli (2018). *La Rivista del Nuovo Cimento.* Issue **8**, pp. 415-461. DOI: 10.1393/ncr/i2018-10150-2

186. **The life of proteins under mechanical force.** Schönfelder, J., Alonso-Caballero, A., De Sancho, D., Perez-Jimenez, R. (2018) *Chemical Society Reviews*, **47** (10), pp 3558-3573. DOI:10.1039/C7CS00820A

187. **Instrumental Effects in the Dynamics of an Ultrafast Folding Protein under Mechanical Force.** De Sancho, D. Schönfelder, J., Best, R.B. Perez-Jimenez, R. Munoz, V. *J. Phys. Chem. B*, 2018, **122** (49), pp 11147–11154. DOI: 10.1021/acs.jpcb.8b05975

188. **Reconstruction of the time-dependent electronic wave packet arising from molecular autoionization.** Bello RY, Canton SE, Jelovina D, Bozek JD, Rude B, Smirnova O, Ivanov MY, Palacios A, Martín F. (2018) *Science Advances,* **4** (8). DOI: 10.1126/sciadv.aat3962

189. **Glutton: A tool for generating structural ensembles of partly disordered proteins from chemical shifts.** He Y, Nagpal S, Sadqi M, de Alba E, Muñoz V. *Bioinformatics*. (2018). DOI: 10.1093/bioinformatics/bty755

190. **Targeting autophagy using metallic nanoparticles: a promising strategy for cancer treatment.** Cordani M. Somoza Á. (2018) *Cellular and Molecular Life Sciences,* pp 1-28. DOI: 10.1007/s00018-018-2973-y

191. **ϖ-Extended Corannulene-Based Nanographenes: Selective Formation of Negative Curvature.** Fernández-García JM, Evans P.J., Medina Rivero S., Fernández I., García-Fresnadillo D., Perles J., Casado J., Martín, N. (2018) *Journal of the American Chemical Society,* **140** (49), pp. 17188–17196. DOI: 10.1021/jacs.8b09992

192. **Quantitative determination of a model organic/insulator/metal interface structure.** Schwarz, M., Duncan, D.A., Garnica, M., Ducke, J., Deimel, P.S., Thakur, P.K., Lee, T.-L., Allegretti, F., Auwärter, W. *Nanoscale.* 2018, **10**, pp. 21971-21977. DOI: 10.1039/c8nr06387g

193. **Bias-Driven Conductance Increase with Length in Porphyrin Tapes.** Leary E., Limburg B., Alanazy A., Sangtarash S., Grace I., Swada K., Esdaile L.J., Noori M., González M.T., Rubio-Bollinger G., Sadeghi H., Hodgson A., Agraït N., Higgins S.J., Lambert C.J., Anderson H.L., Nichols R.J. *Journal of the American Chemical Society* (2018) **140**(40), pp 12877-12883. DOI: 10.1021/jacs.8b06338

194. **Graphene catalyzes the reversible formation of a C–C bond between two molecules** J. J. Navarro, M. Pisarra, B. Nieto-Ortega, J. Villalva, C. G. Ayani, C. Díaz, F. Calleja, R. Miranda, F. Martín, E. M. Pérez, A. L. Vázquez de Parga. *Sci. Adv.* **4**, eaau9366 (2018). DOI: 10.1126/sciadv.aau9366

195. **Synergy of light harvesting and energy transfer as well as short-range charge shift reactions in multicomponent conjugates.** Fazio E., Winterfeld K.A., López-Pérez A, Torres T., Guldi D.M., de la Torre, G. *Nanoscale*, 2018, **10**, pp. 22400-22408. DOI: 10.1039/C8NR08438F

196. **Thermoelectric properties of 2,7-dipyridylfluorene derivatives in single-molecule junctions.** Yzambart, G., Rincón-García, L., Al-Jobory. A.A., Ismael, A.K., Rubio-Bollinger, G., Lambert, C.J., Agraït, N., Bryce, M.R. *J. Phys. Chem. C*, 2018, **122** (48), pp 27198–27204. DOI: 10.1021/acs.jpcc.8b08488

197. **A pump-probe scheme with a single chirped pulse to image electron and nuclear dynamics in molecules.** Jelovina, D., Feist, J., Martín, F., Palacios, A. *New J. Phys.* **20** (2018) 123004. DOI: 10.1088/1367-2630/aaf196

198. **Dibenzoquinquethiophene- and Dibenzosexithiophene-Based Hole-Transporting Materials for Perovskite Solar Cells.** Urieta-Mora, J., Zimmermann, I., Aragó, J., Molina-Ontoria, A., Ortí, E., Martín, N., Nazeeruddin, M.K. *Chemistry of Materials* (2018) Advance Article. DOI:10.1021/acs.chemmater.8b04003

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

200. **Electrostatic effects, band distortions, and superconductivity in twisted graphene bilayers.** Guinea, F., Walet, N.R. *Proc Natl Acad Sci* U S A, 2018 **115** (52) pp 13174-13179. DOI: 10.1073/pnas.1810947115

1.2. Contributions to books

1. **CHAPTER 7: Theoretical Methods for Attosecond Coupled Electron-nuclear Dynamics in Molecular Photoionization.** Palacios, A., Sanz-Vicario, J.L., Martín, F. (2018) *RSC Theoretical and Computational Chemistry Series,* 2018-January (13), pp. 218-274. DOI: 10.1039/9781788012669-00218

2. **CHAPTER 11: Electrochemical nucleic acid sensors based on nanomaterials for medical diagnostics.** Campuzano, S., Yáñez-Sedeño, P., Pingarrón, J.M. (2018) *Nanotechnology and Biosensors*, pp. 319-351. DOI: 10.1016/B978-0-12-813855-7.00011-8


instituto
imdea
nanoscience

1.3. Patents

Title	Publication Number	Publication Date	Inventor(S)	
Ferrite type materials and process for the production thereof	WO2018211121 (A1)	2018-11-22	Real Alberto Bollero [ES]; Deledda Stefano [NO]; Camarero De Diego Julio [ES]; Guzik Matylda [NO]; Rodríguez Javier Rial [ES]	
Polymeric composites with functional surfaces	Wo2017167909 (A1)	2017-10-05	Hernández Rueda Jaime [Es], Hernández Rueda Jaime [Es], Rodríguez Fernández Isabel [Es], Navarro Baena Iván [Es], Viela Bovio Felipe [Es]	
Covalently modified graphene	WO2016124803 (A1)	2016-08-11	Calleja Mitjá Fabián [Es], Leret García Sofía [Es], Navarro Ocaña Juan Jesús [Es], Stradi Daniele [Dk], Black Morocoima Andrés [Es], Bernardo Gavito Ramón [Es], Garnica Alonso Manuela [Es], Granados Ruiz Daniel [Es], López Vázquez De Parga Amadeo [Es], Pérez Álvarez Emilio [Es], Miranda Soriano Rodolfo [Es]	
Systems and methods for obtaining unique identifiers and measuring displacements by sensing and analizing spatial magnetic field variations	EP3246722 (A1)	2017-11-22	Pedrosa Ruiz Francisco Javier [Es], Camarero De Diego Julio [Es], Bollero Real Alberto [Es]	
Modified solid support for the synthesis of oligonucleotides	US2016075680 (A1)	2016-03-17	Somoza Calatrava Alvaro [Es], Latorre Lozano Alfonso [Es]	
Detection and treatment of gnaq mutant uveal melanoma cells with gold nanoparticles	WO2015116502 (A1)	2015-08-06	Urda Susana Ortiz [Us], Somoza Calatrava Alvaro [Es], Latorre Lozano Alfonso [Es], Posch Christian [Us]	
Production of corrugated and porous graphene from cof for the use thereof as supercapacitors	ES2538604 (A1); ES2538604 (B1)	2015-06-22	Coronado Miralles Eugenio [Es], Ribera Hermano Antonio Luis [Es], Abellan Saez Gonzalo [Es], Zamora Abanades Félix [Es], Mas Balleste Rubén [Es], Rodriguez San Miguel David [Es]	
Functionalised magnetic nanoparticle	WO2016150521 (A1)	2016-09-29	López Cortajarena Aitziber [Es], Somoza Calatrava Álvaro [Es], Couleaud Pierre [Es], Ocampo García Sandra [Es], Aires Trapote Antonio [Es], Latorre Lozano Alfonso [Es]	
Functionalized metal nanoparticles and uses thereof for detecting nucleic acids	EP3099814 (A1)	2016-12-07	Somoza Calatrava Álvaro [Es], Latorre Lozano Alfonso [Es], Ortiz Urda Susana [Us], Posch Christian [Us]	
Method for the synthesis of covalent organic frameworks	WO2015015035 (A1)	2015-02-05	Zamora Abanades Félix Juan [Es], Mas-Ballesté Rubén [Es], Rodríguez San Miguel David [Es], Segura Castedo José Luis [Es], De La Peña Ruigómez Alejandro [Es]	
Graphene dried powder and method for its preparation	WO2015014862 (A1)	2015-02-05	Miranda Soriano Rodolfo [Es], Zamora Abanades Félix Juan [Es], Mas-Ballesté Rubén [Es], Azani Mohammad-Reza [Es], Carcelén Valero Verónica [Es], Castellano Doblaré Manuel [Es]	
Position-sensitive photodetector, method for obtaining same and method for measuring the response from the photodetector	ES2384766 (A1); ES2384766 (B1)	2012-07-12	Cabanillas Gonzalez Juan [Es], Campoy Quiles Mariano [Es]	
Position-sensitive photodetector, method for obtaining same and method for measuring the response from the photodetector	EP2650939 (A1)	2013-10-16	Cabanillas Gonzalez Juan [Es] Campoy Quiles Mariano [Es]	

	Applicant(S)	International Classification	Date Of Application	International Search Citation
	INST ENERGITEKNIK [NO]; FUND IMDEA NANOCIENCIA [ES]	C04B35/26, C01G49/00, C01G49/02, C01G49/06, C01G49/08, C04B35/626, H01F1/00, H01F1/01, H01F1/03, H01F1/032, H01F1/10, H01F1/34, H01F1/36	2018-05-18	
	Fundación Imdea Nanociencia [Es]	B29C59/02 B29C70/64 B32B3/30 H01L51/00	20170330	US2013115420 (A1) US2014072720 (A1) US2005103457 (A1) US2013251948 (A1)
	Fundación Imdea Nanociencia [Es] Univ Autónoma De Madrid [Es]	C01B31/04 H01L21/20 H01L31/028	20160202	WO2008097343 (A2)
	Fundación Imdea Nanociencia [Es]	G01R33/10 G07D7/04	20160520	
	Fundación Imdea Nanociencia [Es] Fundacion Imdea Nanociencia [Es]	C07D339/04	20140429	
	Univ California [Us] Fundacion Imdea Nanociencia [Es]	C12Q1/68	20150123	US2009137418 (A1) US2013102653 (A1) US2004072157 (A1) US6221397 (B1) US2011223195 (A1) US2010201381 (A1)
	Uni De València [Es] Univ Madrid Autonoma Fundación Imdea Nanociencia	H01G9/042 B82Y30/00 B82Y40/00	20131122	
	Fundación Imdea Nanociencia [Es]	A61K47/48 A61P35/00	20150326	US2011165086 (A1) WO2008073856 (A2) KR20100070171 (A) CN102631687 (A) WO2006113668 (A1) WO02094325 (A2)
	Fundación Imdea Nanociencia [Es] Univ California [Us]	C12Q1/68	20150202	WO2007059514 (A2) WO0218951 (A2) US2010201381 (A1) WO2014149071 (A1)
	Fundación Imdea Nanociencia [Es] Univ Autónoma De Madrid [Es] Univ Madrid Complutense [Es]	C08G73/02 G03G5/05	20140730	US2010224867 (A1) WO2012039683 (A1)
	Fundación Imdea Nanociencia [Es] Univ Autónoma De Madrid [Es] Abengoa Res S L [Es]	C01B31/04 C08K3/24 C09D5/24 C09D7/12 C09D11/00	20140729	WO2013036272 (A1) US7097788 (B2) WO2012051597 (A2) WO2011162727 (A1)
	Fundacion Imdea Nanociencia [Es] Consejo Superior Investigacion	H01L51/42	20101210	
	Fundacion Imdea Nanociencia [Es] Consejo Superior Investigacion [Es]	H01L51/42	20111207	

In numbers...

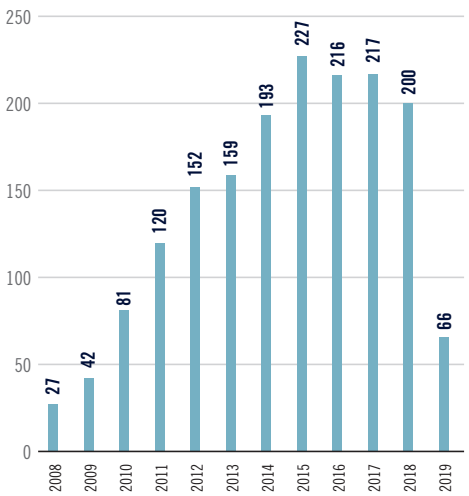
publications

Nº of publications	Sum of the times cited	Average citation per item	h index
1.700	38.139	22,43	86

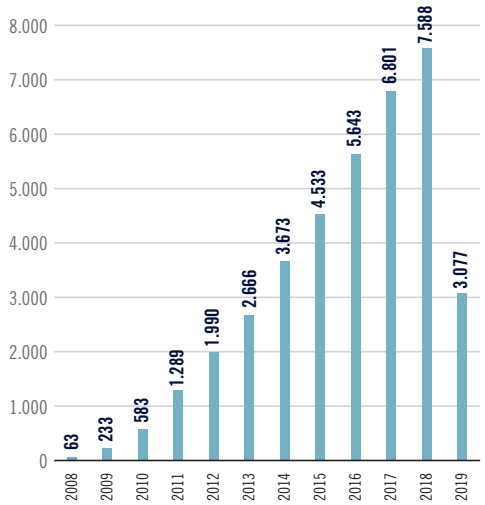
2018

Nº of publications	Average impact factor	Q1 publications	D1 publications
200	8,20	>75%	>30%

Publications in each year



Citations in each year



highly cited researchers

2. International Congresses

2.1. Invited lectures

17/01/2018

2nd Frontiers of Organic Semiconductor Lasers, South China University of Technology, Guanghzhou, 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. Martin

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

XVIII Escuela Nacional de Materiales Moleculares

R. Miranda

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

NILIndustrial 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 Glycodendrol[60]Fullerene onoadducts

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)

J. J. Navarro, F. Calleja, B. Nieto-Ortega, M. Pisarra, C. Díaz, F. Martin, R. Miranda, E. M. Pérez, A.L. Vázquez de Parga

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

H. D. A. Santos, E. Ximendes, C. Jacinto, D. Ortega, I. Rubia, M. C. Iglesias de la Cruz, I. Chaves-Coira, L. Monje, D. Jaque and N. Fernandez

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. Martín

04/07/2018

Physical Chemistry Colloquium, Ludwig-Maximilians Universität München, Munchen, Germany

Multivalent Glycofullerenes for Ebola Virus Infection

N. Martín

05-07/07/2018

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

AM30 Symposium Dresden. Advanced Carbon and 2D Materials (Advanced Materials 30th Anniversary. Wiley, Dresden, Germany

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. Martín

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 MnAl

A. Bollero; J. Rial; E. M. Palmero; J. Camarero; P. Švec; P. Švec Sr.

03-07/09/2018

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 (IMPRA 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

CURO-pp3. The Third International Symposium on the Synthesis and Applications of Curved Organic ϖ-Molecules & Materials, University of Oxford, UK

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 Elctronics Technologies, Melbourne, Australia

Graphene as playground for molecules: from physisorption to catalysis

A.L. Vázquez de Parga

20/09/2018

2nd InternationalWorkshop 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

12 th 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

Topologicallly 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

Syntehtic 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. Vazquez 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

D. H. Ortgies, U. Rocha, L. de la Cueva, D. Cabrera, G. Salas, F. J. Teran, A. S. Vanetsev, M. Rähn, V. Sammelselg, Y. V. Orlosvkii, and D. Jaque.

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. Burzurí

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

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 (4GEQB), 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 Physycal Society, Los Angeles, USA

Oral Contribution

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

V. Rollano, F. Valdes-Bango, A. Munoz-Noval, A. Gomez, J. I. Martin, M. Velez, E. M. Gonzalez, J. L. Vicent

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.Martín

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
F Ajejas, D. Maccariello, JM Diez, R. Guerrero, L. Méchin, S. Flament, J. SantaM., J. Camarero, R. Miranda, P. Perna

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

Correlative 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
A. Lak, M. Cassani, N. Winckelmans, B. T. Mai, D. Cabrera, E.Sadrollahi, S.Marras, H. Remmer, S. Fiorito, F.J. Litterst, F.Ludwig, F.J. Teran, J. Lipfert, S. Bals, T.Pellegrino

Taking advantages of nanomagnetism for detecting biomarkers dispersed in biological fluids

D.Cabrera, A. Aires, E. J. Artés-Ibáñez, N. Silvestri,S. Ayyappan, T.Pellegrino, A. L. Cortajarena, F. J. Teran

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

K. Simeonidis, R. Xu, P. Rivera-Gil, F. J. Teran, E. Kokkinos, M. Angelakeris, T. Mitropoulos

01/05/2018

Gold2018, Paris, France

Oral Contribution

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 Moities

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

M.Garnica, A. Riss, J. Ducke, M. Schwarz, A. Pérez-Paz, P.S. Deimel, D.A. Duncan, P.K. Thakur, T.-L. Lee, A. Seitsonen, K. Seufert, A. Rubio, J.V. Barth, W. Auwärter

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

M. M. Otrokov, I. I. Klimovskikh, F. Calleja, A.M. Shikin, O. Vilkov, A.G. Rybkin, D. Estyunin, S. Muff, J.H. Dil, A.L. Vázquez de Parga, R. Miranda, H. Ochoa, F. Guinea, J.I. Cerdá, E.V. Chulkov, A. Arnau

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

C.G. Ayani, P. Casado, A. Norris, J.J. Navarro, J.G. Rodrigo, F. Calleja, A.L. Vázquez de Parga and R. Miranda

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 nanoduamonds
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
A. Latorre, A. Latorre, A. Lázaro, M. Calero, C. Rodríguez, C. Coutinho, N. Lafuente, M. Cordani, T. Aguado, A. Crespo, M. Lecea, P. Martín-Duque, Á. Villanueva, J. M. Sánchez-Puelles and Á. Somoza

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 (MNPs)
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
A.C. Carrasco, A. Arnaiz, I. González-Gamboa, C. Yuste-Calvo, F. Sánchez, F. Ponz and A.M. Pizarro

Osmium(II) and ruthenium(II) arene organometallic complexes with carboxylate groups for nanoparticle funtionalization
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. Bondia, 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, A. González-Mayorga, M.C. 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. Wannemacher

Synthesis and advanced 3D-printing of polymerized composites based on metallic particles
D. Casaleiz; E. M. Palmero; 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
A. Jacobo-Martín, I. Navarro-Baena, J.J. Hernández, M.R. Osorio, M.A. Monclús, J.M. Molina-Aldarequia and I. Rodríguez

In vitro study of the thermal stress mediated by iron oxide nanoparticles sujected 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
V. Muñoz, B.L. Rodilla, R. Guerrero, L. Pérez, J. Camarero, R. Miranda, M.T. González

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.Rodríguez-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. García-Soriano, R. Amaro, L. Gutiérrez, G Salas

18/06/2018

Kick off meeting Euronanomed3, Technische Universiteit Eindhoven, Eindhoven, The Netherlands

Oral Contribution

Photosensitizers based on Phthalocyanines for Photodynamic Therapy
T. Torres

18/06/2018

SolSkyMag 2018, San Sebastián-San Sebastian, Spain

Oral Contributions

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

18-22/06/2018

E-MRS Spring Meeting 2018, Strasbourg, France

Oral Contributions

"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

Metallation 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 ellectronically isolated fullerene nanocrystals
A. Martín. 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 mitocondrial DNA helicase (TWINKLE) with SSB proteins and the human mitochondrial DNA polymarase

Lemishko K, Cielsieski G, Kaguni LS, Ibarra B

Mechano-chemical characterization of membrane fission by dynamin

Bocanegra-Rojo R, de Lorenza S, Velasco, A, Carrascosa JL, Frolov V, Ibarra B

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

L. Lüer, J. Shi, A. Isakova, A. Abudulimu, M. van den Berg, O.K. Kwon, A.J. Meixner, S.Y. Park, D. Zhang, J. Gierschner

24-25/06/2018

6th International Workshop on 2D Materials, Tenerife, Spain

Oral Contribution

Prespectives on Antimonene

F. Zamora

24-29/06/18

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

C.G. Ayani, P. Casado, A. Norris, J.J. Navarro, J.G. Rodrigo, F. Calleja, A.L. Vázquez de Parga and R. Miranda

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)

A.Sanchez-Grande, J. Rodriguez-Fernandez, E. Carrasco, K. Lauwaet,J. Fester, R. Miranda, J. V. Lauritsen, D. Écija

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

D. H. Ortgies, D. Cabrera, L. de la Cueva, U. Rocha, G. Salas, F. J. Teran, A. S. Vanetsev, M. Rähn, V. Sammelselg, Y. V. Orlovskii, and D. Jaque.

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. Milosevic, 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. Vallejo-Fernandez, 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 syntehetic 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 asymmeties

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

A. Migliorini, B. Kuerbanjiang, D. Kepaptsoglou, M. Muñoz, J.L.F. Cuñado, J. Camarero, C. Aroca, G. Vallejo-Fernandez, V. Lazarov and J.L. Prieto

Poster Contributions

ByAxon: Towards an active bypass for neural reconnection

T. González, B.L. Rodilla, V. Muñoz, R. Guerrero, P. Perna, L. Pérez, L. Ballerini, L. Méchin, M.C. Serrano-Terradas, E. Dolado, J. Camarero and R. Miranda

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

S. Ruiz-Gomez, C. Fernández-González, M. Förster, L. Aballe, R. Guerrero, J. de la Figuera, A. Quesada, A. Mascaraque y L. Perez

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. Švec; P. Švec 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

Plasmonic Properties of Electrolytes Beyond Classical Nanophotonics - A Two-fluid, Hydrodynamic Approach to Nonlocal Soft Plasmonics

C. David

06/08/2018

British Society for Neuroendocrinology 2018, London, UK

Oral Contribution

Smart Nanoparticles for the Treatment of Cancer

Á Somoza, A. Latorre, A. Latorre, A. Lazaro-Carrillo, T. Aguado, A. Crespo, M. Calero, M. Lecea, P. MartínDuque, J. M. Sanchez-Puelles, A. Villanueva.

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. Martínez-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

26/08/2018

XXVI ICORS – International Conference on Raman Spectroscopy, Jeju, South Corea

Oral Contribution

TiO2 Nanotube Electrodes for Surface Enhanced Raman Spectroelectrochemistry

I. H. Öner, C. J. Querebillo, C. David, K. H. Ly, and I. M. Weidinger

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 nanostrctured 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)

M. M. Otrokov, I. I. Klimovskikh, F. Calleja, A.M. Shikin, O. Vilkov, A.G. Rybkin, D. Estyunin, S. Muff, J.H. Dil, A.L. Vázquez de Parga, R. Miranda, H. Ochoa, F. Guinea, J.I. Cerdá, E.V. Chulkov, A. Arnau

Reversible C-C bond formation in a surface reaction catalysed by graphene on Ru(0001)

J.J. Navarro, M. Pisarra, B. Nieto-Ortega, J. Villalva, C. Díaz, 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

A.Sanchez-Grande, J. Rodriguez-Fernandez, E. Carrasco, K. Lauwaet, J. Fester, R. Miranda, J. V. Lauritsen, D. Écija

27/08/2018

Biomolecular Electronics (BIOMOLECTRO2018), 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

M. Pisarra (& C. Díaz, J.J. Navarro, B. Nieto Ortega, J. Villalva, F. Calleja, R. Miranda, E. M. Pérez, A.L. Vázquez de Parga, F. Martín)

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

K. Simeonidis, R. Xu, P. Rivera-Gil, F. J. Teran, E. Kokkinos, M. Angelakeris, T. Mitropoulos

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

S. Ruiz-Gomez, M. Muñoz, R. Guerrero, M. Foerster, L. Aballe, M. Amado, J.W.A. Robinson, A. Mascaraque y L. Pérez

Magnetization processes in FeNi cylindrical nanowires with chemical notches

L. Perez, Ruiz-Gomez, C. Fernández-González, M. Foerster, L. Aballe, R. Guerrero, J. Camarero, J. de la Figuera, A. Quesada y A. Mascaraque

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

I. Navarro-Baena, A. Jacobo-Martín, J. J. Hernández, J. R. Castro-Smirnov, M. R. Osorio, F. Viela, M. Monclús, J. Molina-Aldareguia and I. Rodríguez

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
A. Jacobo-Martín, I. Navarro-Baena, J. J. HernándeZ, M. R. Osorio, M. A. Monclús, J. M. Molina-Aldarequia andI. Rodríguez

03/10/2018

10th ECNP International Conference on Nanostructured Polymers and Nanocomposites, San Sebastián, Spain

Poster Contribution

Mechanically Enhanced Nanostructured Polymer Nanocomposite Surface
A. Jacobo-Martín, I. Navarro-Baena, J. J. HernándeZ, M. R. Osorio, M. A. Monclús, J. M. Molina-Aldarequia andI. Rodríguez

07-12/10/2018

Worshop on vortex behavior in unconventional superconductors, Braga, Portugal

Oral Contribution

Topologicallly 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

Poster Contribution

Stochastic dynamics of spatially extended population with Allee effect
Rodrigo Crespo M.

17-20/10/2018

TTN-2018 International Conference: Tunneling Through Nanoscience, Ravello, Italy

Oral Contribution

Superconducting Vortex Dynamics on Spin-Ice Nanomagnets
J. L. Vicent

Poster Contribution

Interplay between two type II superconductors at the nanoscale
V. Rollano, J. del Valle, A. Gomez, J. L. Prieto, E. Navarro, E. M. Gonzalez, I. K. Schuller, J. L. Vicent, A. Munoz-Noval

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

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)

A.Sanchez-Grande, J. Rodriguez-Fernandez, B. Cirera, E. Carrasco, K. Lauwaet,J. Fester, R. Miranda, J. V. Lauritsen, D. Écija

Atomically 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

A. Black, J. Roberts, M. Acebron, R. Bernardo-Gavito, G. Alsharif, F.J. Urbanos, B.H. Juarez, O.V. Kolosov, B.J. Robinson, R. Miranda, A.L. Vázquez de Parga, D. Granados

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

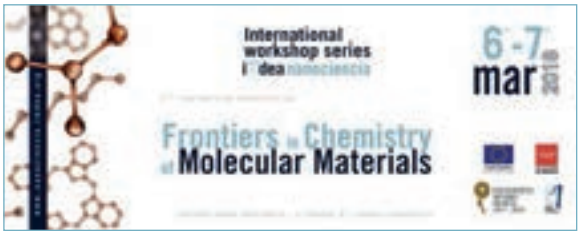
Training: Jornada de Divulgación y Comunicación Científica

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

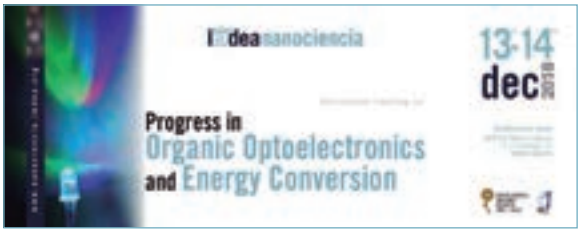
Nobel Prize Winners Symposium

23-25.11.2018

Japan-Spain Symposium π-Figuration

13-14.12.2018

Meeting on Progress in Organic Optoelectronics and Energy Conversion



4. Seminars

Wednesday January 10th 2018

Impact of the Intermolecular Interactions on the Electronic and Charge-Transport Properties of Organic Materials: The Key Role of DFT Calculations

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), Aahurs 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

Attosecond 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

Can light-based therapies improve controlled drug release and therapeutic efficacy?

Dra Pilar Acedo

University College London, UK

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

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

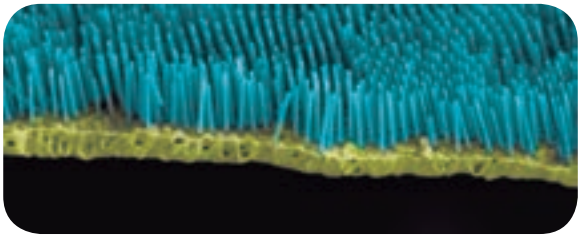
Graphene-based disruptive technologies (GrapheneCore2)

Funding: H2020-FETFLAG-2017 Specific Agreement: n° 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

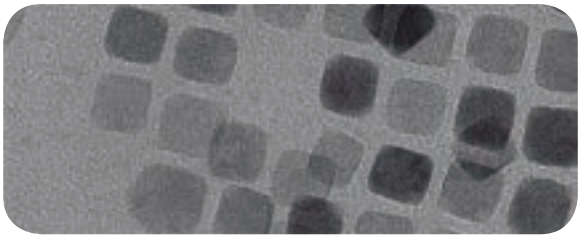
Towards An Artificial Leaf

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 n° 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

NANOLEAP

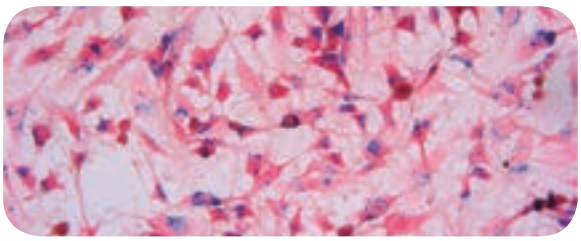
Nanocomposite for building constructions and civil infrastructures: European network pilot production line to promote industrial application case

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

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



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)

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)

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

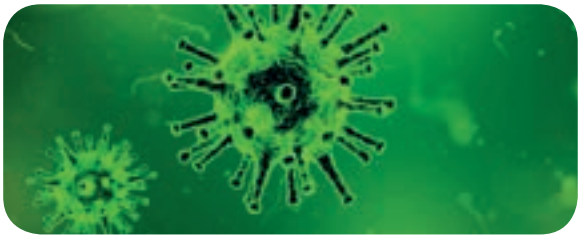
Downhill Folding Protein Modules as conformational Rheostats: Roles in Molecular Biology and Applications in Biosensors

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
PIs: 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 verificacion de predicciones in silico de nanotermometria e hipertermia magnetica

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 generacion de implantes en medicina regenerativa

Ref.: DPI2017-90058-R
Duration: 2018-2020
PIs: Dra. M. Isabel Rodríguez Fernández and Dra. Teresa González

Call 2016

NEWMAG

Nueva generación de imanes basados en MNAL mediante impresión 3D para aplicaciones energéticas

Ref.: EUIN2017-88502
Duration: 2017-2019
PI: Dr. Alberto Bollero

Call 2015

LANTHACOOR

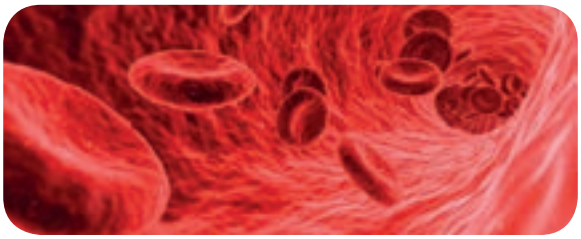
Lanthanide coordination chemistry on surfaces

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

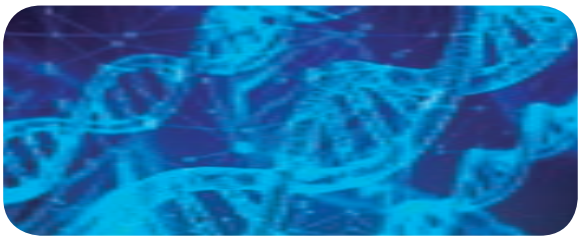
Immunotherapy against high-grade brain tumour with monoclonal antibody

Ref.: RTC-2015-3846-1
Duration: 2015-2018
Pis: 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

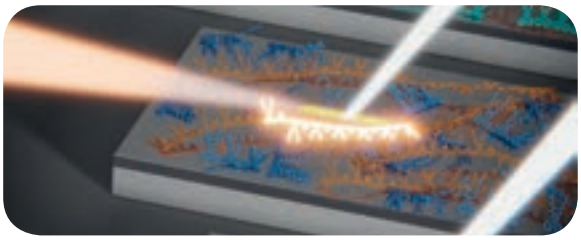
ORGENERGY

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

RENIM-CM

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

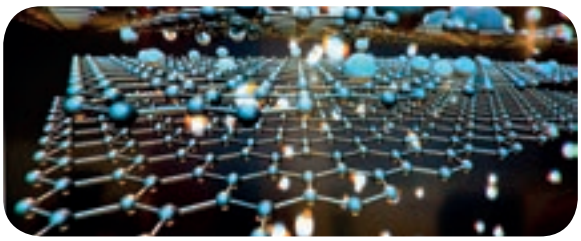
Materiales avanzados de carbono para fotovoltaica molecular

Ref.: S2013/MIT-2841

Duration: 2014-2018

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

IMDEA Research Team: Dr. Larry Luer



MAD2D

Propiedades fundamentales y aplicaciones del grafeno y otros materiales bidimensionales

Ref.: S2013/MIT-3007
Duration: 2014-2018
Coordinator: ICMM-CSIC
IMDEA Research Team: Prof. Francisco Guinea, Dr. Daniel Granados and Dr. Reinhold Wannemacher

5.4. Industrial projects

Höganäs

GAMMA

Company: Höganäs (Sweden)
Duration: 2017-2018
PI: Dr. Alberto Bollero

Industrial PhD Studentship

Company: Höganäs (Sweden)
Duration: 2018-2021
PI: Dr. Alberto Bollero

nanocore
STRENGTH FROM WITHIN

PolyMINTS

Company: Nanocore Aps (Denmark)
Duration: 2018-2019
PI: Dr Emilio Perez

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 Garcia, Daniel Moreno Cerrada, Paula Milán Rois

Call 2016

Patricia Bondia

Call 2015

Sofía Mena

FPU PROGRAMME

Call 2013

Leire de Juan

TECHNICAL SUPPORT SPECIALIST PROGRAMME

Call 2016

Isabel Ortiz

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)

Víctor Marzoa, Sergio Ramírez, Daniel Casaleiz, Carmen Escalona, Ciro Rodriguez, Laura González, Alejandra Jacobo, Ester Resines, Irene Rubia, Adrián Gudin, Jorge Delgado, Vanesa Gonzalez, Javier Álvarez, Lucia Cremades, Juan Carlos Martin, Arturo Vera Garcia.

Research assistants (2 years contract funded)

Elena Sanz, Victoria López, Claudia Lozano

Technicians (2 years contract funded)

Christine Marie Arenas, Rosa Maria Martínez

Call 2016

Predoctorals (3 years contract. 1 year funded)

Sofía Infante, Ana Sánchez, Adrián Valle, David Garcia, Eduardo Garcia, Carlos Rodriguez-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 Garcia

Supervisors: Dr. Alberto Bollero

IES Ramiro de Maeztu, Madrid. 1 week in March 2018.

Students: Gullermo 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 Ecija

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, October 26TH 2018

Mr. Javier Jarillo

Stochastic Dynamics in Physics and Biology

Supervisor: Dr. Francisco J. Cao

Universidad Complutense 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 celular 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

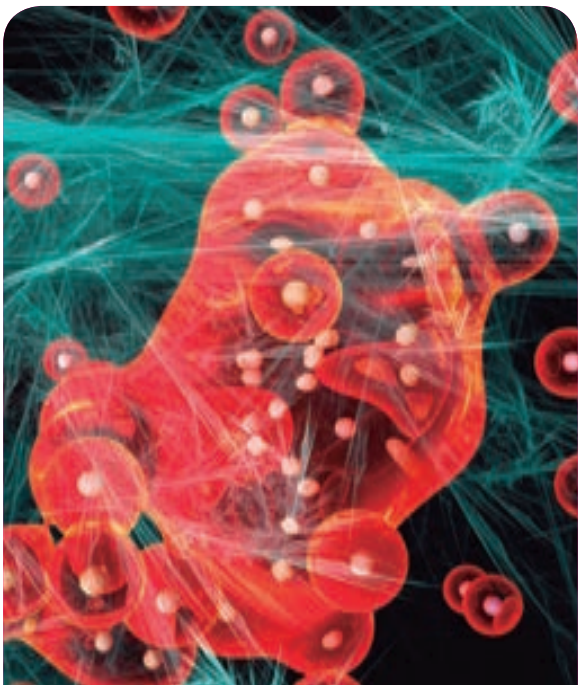
Tuesday, December 18th 2018

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

Universitá di Trento

- Master's Degree in in Mathematical Aspects of Bioelectromagnetism and Imaging

Universidad de Cádiz

- Master's Degree in Biotechnology

External Courses and Seminars

Wednesday, 24th January 2018
Institute Seminar: Seoul National University (Invited Tutorial), Tübingen, Germany
Detection of Loss Channels in Organic Photovoltaic Devices
L. Lüer

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
Á. 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
Á Somoza, A. Latorre, A. Latorre, A. Lázaro-Carrillo, T. Aguado, A. Crespo, M. Calero, M. Lecea, P. Martín-Duque, J. M. Sanchez-Puelles, A. Villanueva.

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
Á. Somoza

Saturday, 22nd September 2018
A.E. Favorsky Irkutsk Institute of Chemistry Siberian Branch of the Russian Academy of Sciences (SB RAS), Irkutsk, Russia
Phthalocyanines and related compounds as components of photovoltaic and artificial photosynthetic systems
T. Torres

Thursday, 27th September 2018
I.ovo State University of Chemistry and Technology (ISUCT), I.ovo, Russia
Subphthalocyanines: Singular, aromatic and chiral, non-planar compounds
T. Torres

Monday, 8th October 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

Thursday, 11th October 2018

École Polytechnique Fédérale de Lausanne, EPFL, Lausanne, Switzerland

Synthetic Chiral Carbon Nanoforms

N. Martín

Monday, 15th October 2018

Department of Physics, Palermo, Italy

Electronic and topological properties of 2D crystals: graphene and beyond

L. Chirolli

Monday, 22th October 2018

Colegio Oficial de Ingenieros Industriales de Madrid, Madrid, Spain

Exposición a sustancias peligrosas a escala nano

G. Salas

Thursday, 25th October 2018

Universidad de Santiago de Compostela, Santiago de Compostela, Spain

Láseres de attosegundos: la cámara superlenta de la física, la química y… la biología?

F. Martín

Monday, 5th November 2018

Max-Planck Institut for Polymer Research Johannes Gutenberg-Universität, Mainz, Mainz, Germany

Phthalocyanines as components for molecular photovoltaics and artificial photosynthetic systems

T. Torres

Wednesday, 7th November 2018

Julius-Maximilians-Universität Würzburg, Würzburg, Germany

Subphthalocyanines and related compounds: Singular aromatic non-planar molecules

T. Torres

Friday, 9th November 2018

Universität Erlangen-Nürnberg, Erlangen, Germany

Phthalocyanines as components for molecular photovoltaics and artificial photosynthetic systems

T. Torres

Tuesday, 20th November 2018

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

Seminar of 2D Materials

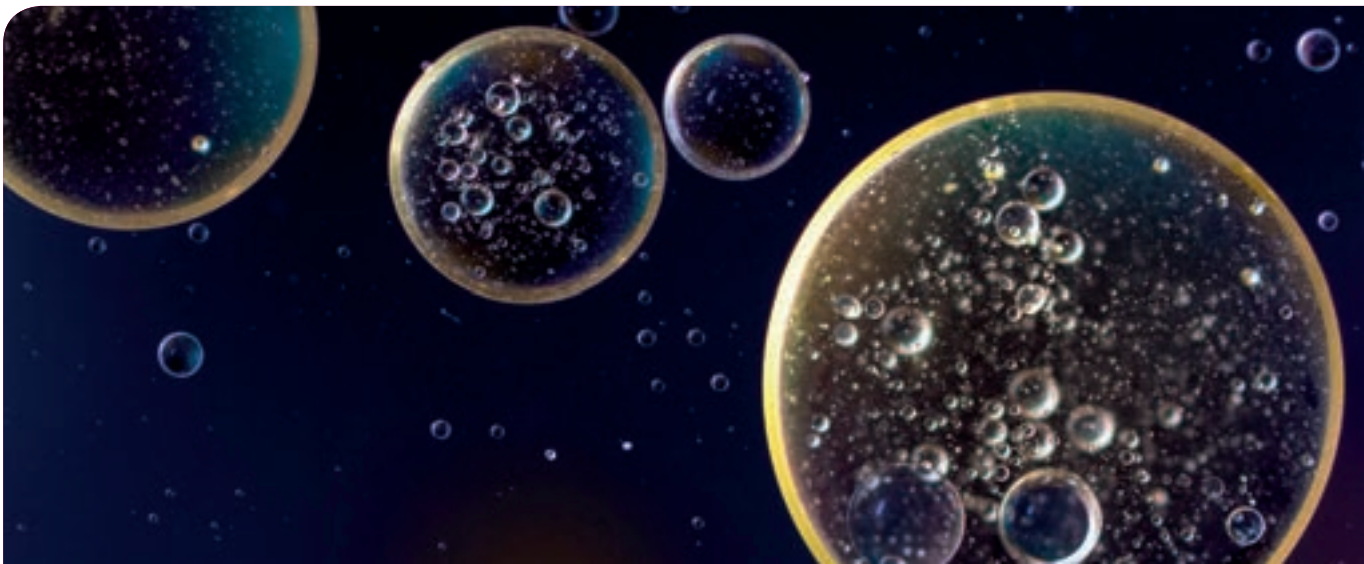
F. Guinea

Thursday, 20th December 2018

School of Chemistry and Biochemistry, Universitè de Genéve, Genéve, Switzerland

Synthetic Chiral Carbon Nanoforms

N. Martín



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)

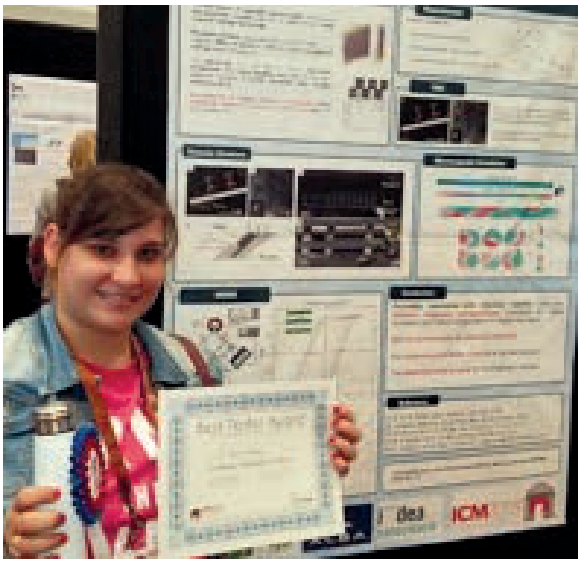
20.03.2018
Alvaro Somoza
Áccesit Award to the project NoCanTher
Madri+d Foundation

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

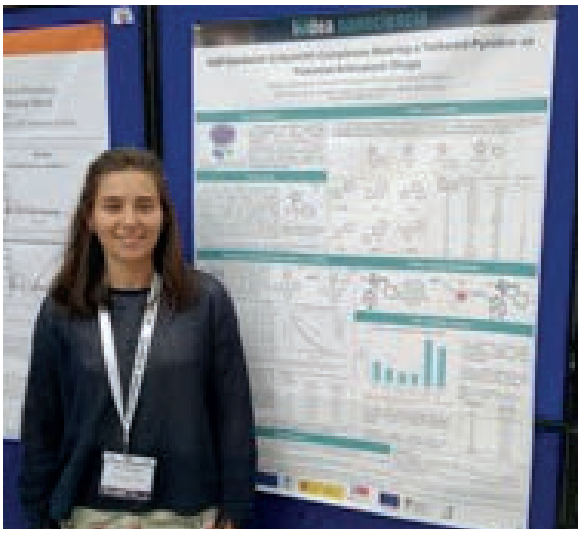
13.06.2018
F. J Urbanos
Nanoscale Oral Communication Prize Award
Nanoscale Journal

18.07.2018
Fernando Ajejas et col.
Best Poster award
ICMM San Francisco

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



31.08.2018
Ana Carrasco
Highly Commended Poster Award
EuroBIC14 Conference in Birmingham

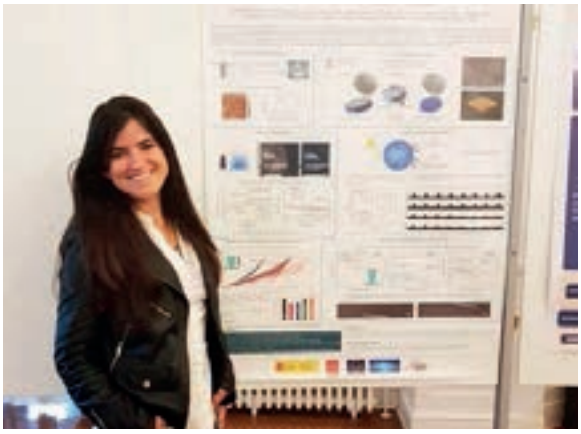


03.10.2018

Alejandra Jacobo

Best poster presentation award

ECNP-2018 Conference in San Sebastian

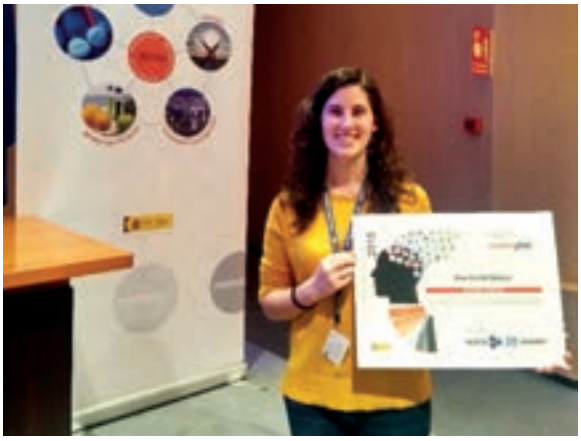


07.11.2018

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

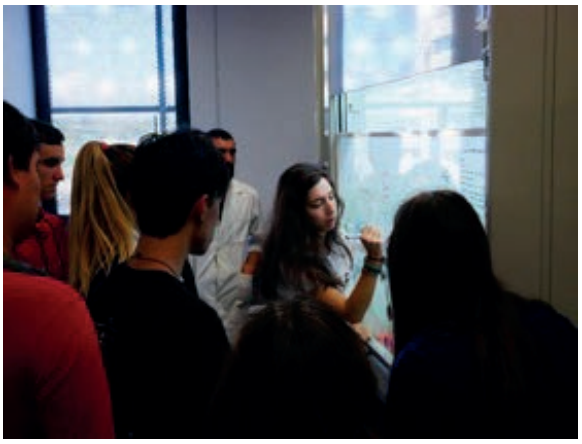
Nanociencia para Todos is the outreach programme of IMDEA Nanociencia. We believe that one of our duties is to contribute to the creation of links between Science and Society in our region. For this purpose, through this programme, *Nanociencia para Todos*, we showcase the Nanoscience directly from our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

Sagrado Corazón School.

Students of the summer course "Nanociencia y Nanotecnología" of the Alcalá de Henares University.

Sagrado Corazón School.

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 Martin 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

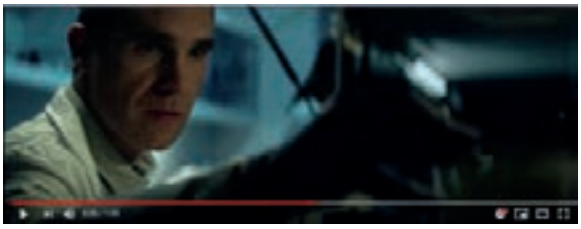
Bolas de azúcar de fullerenos contra el virus del ébola

15.05.2018

Lucas Perez talks for *Pint of Science*

07.06.2018

TV Commercial Ad of the Spanish Association Against Cancer AECC



07.06.2018

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

27.06.2018

Francisco Guinea – Talk "Materia condensada" at the seminar "Poder economico, poder científico" of Menendez Pelayo University.

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

28.09.2018

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

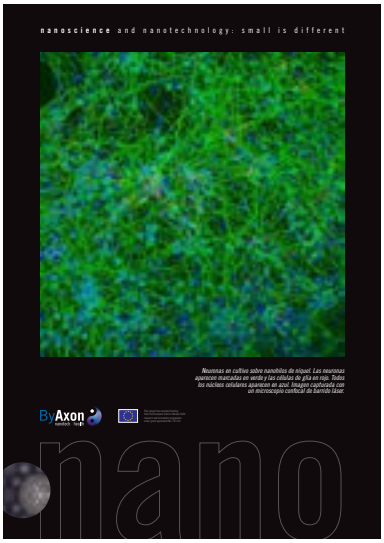
Semana de la Ciencia - Museo de la ciencia de Orihuela (Alicante)

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 Autonoma 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

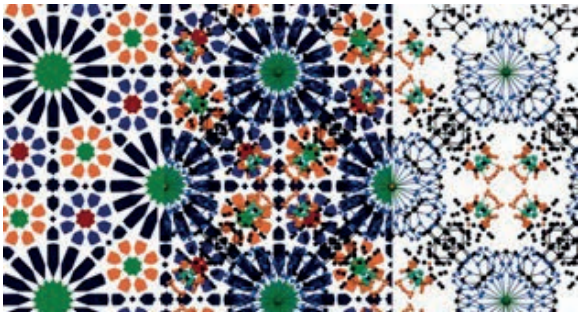
Cómo observar el movimiento combinado de núcleos y electrones.

F. Martín, *Nature Physics.*

05.06.2018

Un material moderno hecho en Madrid se asemeja a un mosaico de la Alhambra del siglo XIV

Jose Sánchez Costa *et al*, *Chem. Commun.*



31.05.2018

XII Simposio de Avances y Resultados de la Fundación AECC

Alvaro Somoza

13.06.2018

Early Stage Researchers Workshop Prizes.

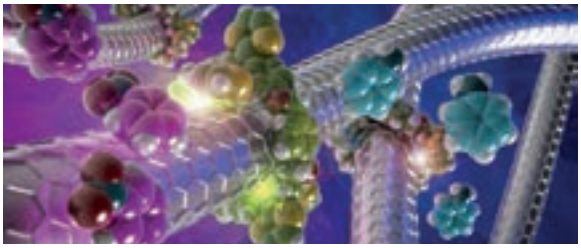
22.06.2018

Interview Rodolfo Miranda CONICET Santa Fe, Argentina

11.07.2018

Anillos moleculares para controlar la actividad catalítica de los nanotubos

Emilio Pérez et al. *Nat. Commun.*



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

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.*

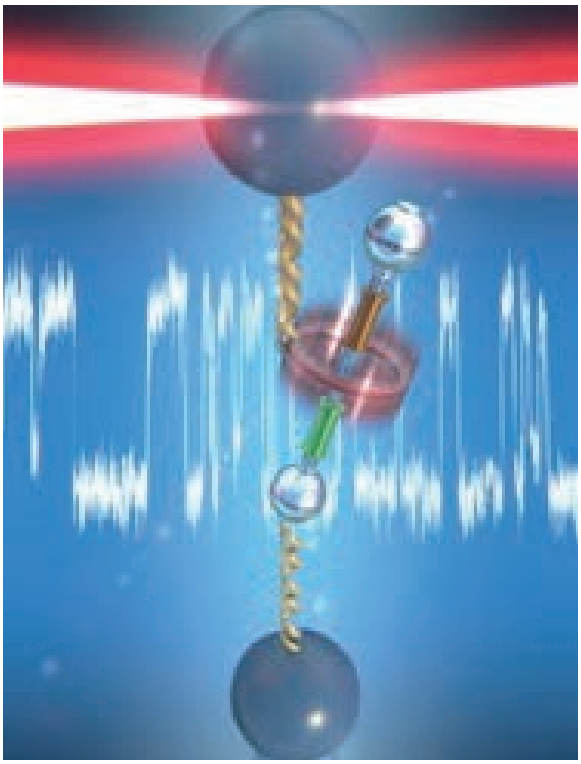
25.10.2018

ByAxon FET project shine at European Researcher's Night

31.10.2018

Cinco minutos en la vida de una nanomáquina molecular

Emilio Pérez, Borja Ibarra et al. *Nat. Commun*



Behind the paper. Editor's highlights

11.2018

NEXMAG – Success story of M-Era.Net

06.11.2018

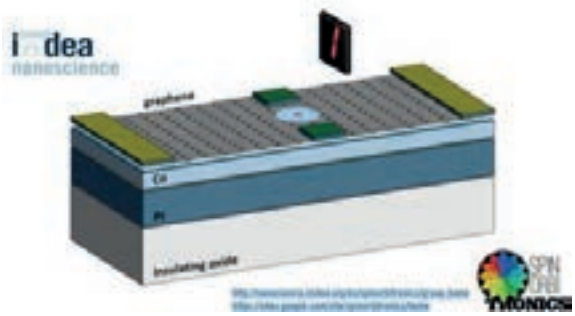
Activities of Semana de la Ciencia

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"

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/

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

07.06.2018
https://www.youtube.com/watch?v=hSFXTtDTHKo

27.06.2018
http://www.uimp.es/agenda-link.html?id_actividad=63XB&anyaca=2018-19

05.07.2018
https://www.ucm.es/cursosdeverano/noticias/26906

26.09.2018
http://www.rtve.es/alacarta/audios/por-tres-razones/tres-razones-tres-proyectos-innovadores-contra-cancer-26-09-18/4755698/

25.09.2018
http://www.lacerca.com/noticias/universidad/docentes-uclm-participan-proyecto-divulgacion-centrado-ninos-sordos-438034-1.html **mentioned**
https://www.lavanguardia.com/local/madrid/20180926/452046236181/investigadores-de-la-uam-ensenan-ciencia-a-jovenes-con-discapacidad-auditiva.html **mentioned**

28.09.2018
http://www.rtve.es/alacarta/audios/por-tres-razones/tres-razones-como-se-resuelve-crimen-gracias-ciencia/4760558/

28.09.2018
http://cadenaser.com/emisora/2018/09/28/ser_toledo/1538127218_439735.html

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

24.10.2018
https://www.youtube.com/channel/UCZXr8VShT6DZo_kd0L1Yq9g

6.11.2018
https://asoc-fulbright.es/2018/10/19/tertulia-de-noviembre-2018-el-tsunami-de-la-nanotecnologia-prof-d-rodolfo-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/

20.11.2018
https://www.conferenciah2020.es/es/h2020conf2018/Inicio/

In the media

07.02.2018
https://www.madridiario.es/453109/hospital-san-carlos **mentioned**

04.04.2018
http://www.eleconomista.es/ecoaula/noticias/9057569/04/18/Ciencia-y-arte-unidas-en-la-tercera-edicion-del-Festival-de-Nanociencia-y-Nanotecnologia.html **mentioned**

08.05.2018
http://www.madrimasd.org/notiweb/analisis/desarrollo-sostenible-nuevos-imanes-permanentes-made-europe-un-reducido-impacto-medioambiental

15.05.2018
http://www.lacerca.com/noticias/guadalajara/pint-of-science-2018-festival-ciencia-bares-guadalajara-419334-1.html **mentioned**

21.05.2018
http://www.agenciasinc.es/Noticias/Como-observar-el-movimiento-combinado-de-nucleos-y-electrones

05.06.2018
https://www.chemistryworld.com/news/ramrod-mof-resembles-alhambra-moasic/3009062.article
https://phys.org/news/2018-06-modern-porous-material-resembles-xiv.html?utm_source=menu&utm_medium=link&utm_campaign=item-menu
http://www.madrimasd.org/notiweb/noticias/un-material-moderno-hecho-en-madrid-se-asemeja-un-mosaico-alhambra-siglo-xiv

31.05.2018
https://www.consalud.es/pacientes/el-cancer-oseo-infantil-podra-ser-tratado-sin-quimioterapia-intravenosa_51089_102.html **mentioned**
http://elmedicointeractivo.com/la-nanotecnologia-permite-optimizar-la-quimioterapia-en-cancer-oseo-infantil/ **mentioned**

13.06.2018
http://blogs.rsc.org/nh/2018/06/19/congratulations-to-the-prize-winners-at-esrw-2018/?doing_wp_cron=1529513222.2233190536499023437500

22.06.2018
http://ww.santafe-conicet.gov.ar/la-nanotecnologia-es-una-especie-de-tsunami/
https://chemistrycommunity.nature.com/users/169710-emilio-m-perez/posts/36282-catalysts-in-mint-condition
https://www.chemistryworld.com/news/macrocycles-power-up-carbon-nanotubes-/3009488.article
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
http://www.madrimasd.org/notiweb/noticias/se-fabrica-primer-filamento-iman-permanente-libre-tierras-raras-basado-en-mnal
https://www.azom.com/news.aspx?newsID=49377
https://www.lavanguardia.com/local/madrid/20180718/45954957466/fabricado-el-primer-filamento-de-iman-permanente-libre-de-tierras-raras.html

18.07.2018
http://www.rsc.org/news-events/journals-highlights/2018/jul/a-molecular-braid/?utm_content=18-Jul-2018&utm_source=twitter&utm_medium=social&utm_campaign=mkt-dir-chemscipicks
https://www.chemistryworld.com/news/nanotube-locked-inside-a-porphyrin/3009279.article

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

28.08.2018
https://eldiadigital.es/not/268139/nanotecnologia-contra-el-cancer/

26.09.2018
https://www.lavanguardia.com/local/madrid/20180926/452046479369/la-noche-de-los-investigadores-vuelve-este-viernes-con-mas-de-50-actividades.html **mentioned**

10.10.2018
https://www.madridiario.es/460937/la-ix-noche-europea-de-los-investigadores-e-investigadoras-de-madrid-culmina-con-gran-exito-de-convocatoria **mentioned**

15.10.2018

https://www.nanowerk.com/nanotechnology-news2/newsid=51277.php
https://www.technology.org/2018/10/16/metal-organic-frameworks-ready-for-electronics/
https://www.nanowerk.com/nanotechnology-news2/newsid=51288.php

25.10.2018

http://www.fetfx.eu/story/fet-projects-shine-european-researchers-night-2018/

31.10.2018

https://chemistrycommunity.nature.com/channels/1465-behind-the-paper/posts/40413-five-minutes-in-the-life-of-a-molecular-shuttle
https://www.nanowerk.com/nanotechnology-news2/newsid=51382.php
https://www.technology.org/2018/10/31/five-minutes-in-the-life-of-a-molecular-shuttle/
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21.12.2018

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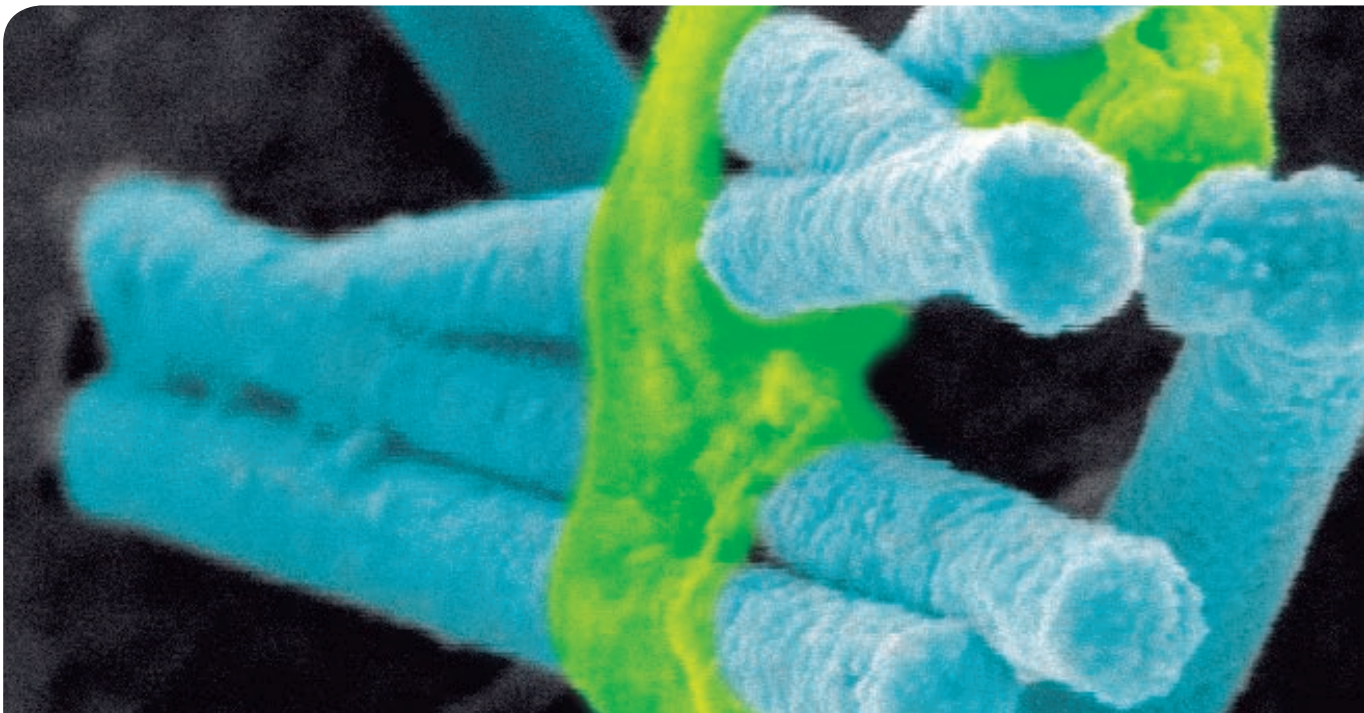


4

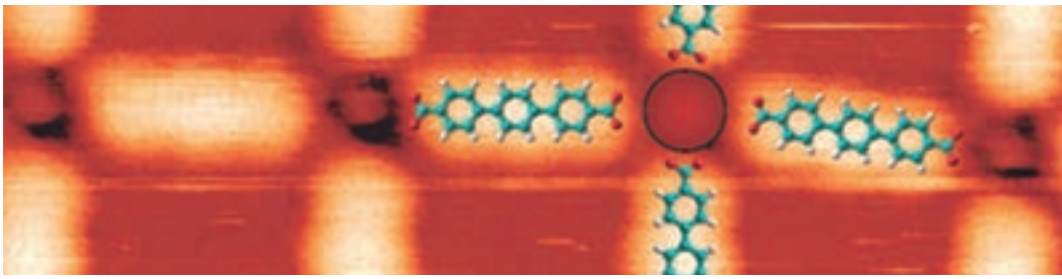
research focus

annual report 2018

1. ELECNANO

Electrically tunable functional lanthanide nanoarchitectures on surfaces

ELEC nano



Lanthanide metals

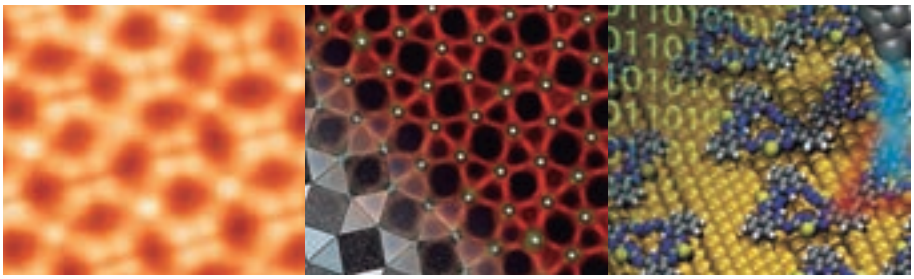
Lanthanide metals are nowadays in the core of a plethora of applications including sensors, catalysis, displays, lasers, optical fibers and magnetic storage units. Their supreme characteristics for sensing, nanomagnetism and emission of light arise from ther electronic structure (f orbitals) which quantum 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 sp^2 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

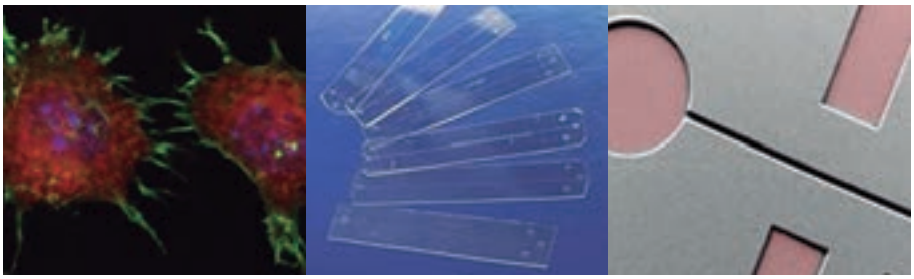
David Écija Fernández (IMDEA Nanociencia)

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



Future and Emerging Technologies (FET-Open)

Cancer therapies

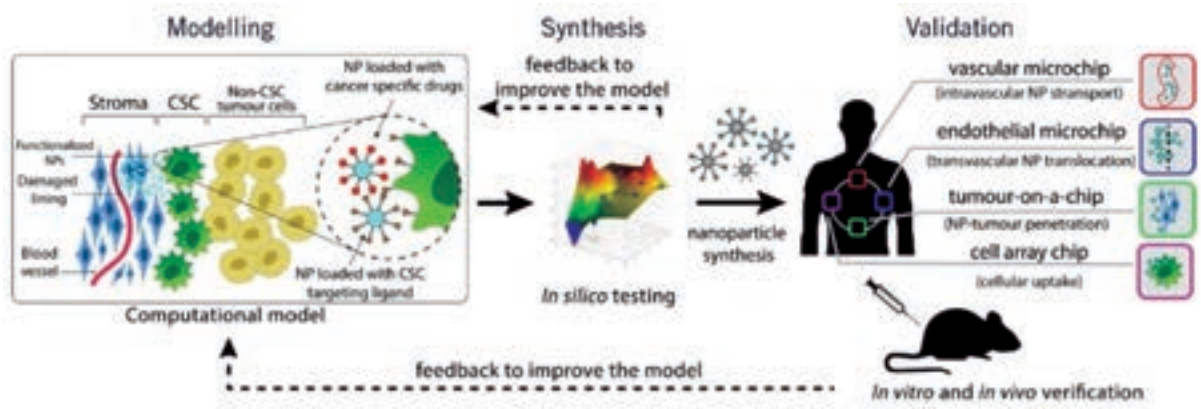
Nanoparticles are increasingly being studied in cancer research for their ability to improve diagnosis accuracy and/or deliver tailored treatments directly to tumours. However, their effective biodistribution is still a major limitation. A key challenge is to discover how to program-design the collective 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).

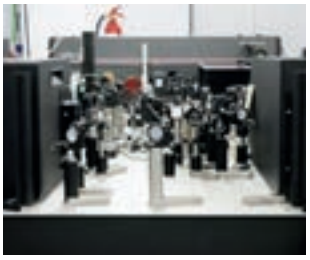
5

facilities

1. RedLab – Network of laboratories of the Regional Government of Madrid

rla red de laboratorios Sistema madrid+d

278
Laboratory of Surfaces
Contact: F. Calleja



279
Laboratory of Advanced Optical Characterization
Contact: J. Cabanillas

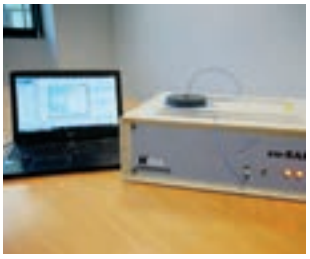
280
Laboratory of Femtosecond Spectroscopy
Contact: L. Lüer

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

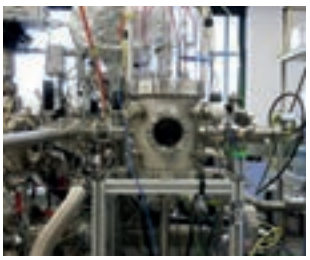


398
Laboratory of the Instrumentation Service
Contact: F. Terán

416
Laboratory of Molecular Motors Manipulation
Contact: B. Ibarra

417
Laboratory of Oligonuclecleotides and Modified Particles
Contact: Á. Somoza

432
Laboratory of Nanostructured Functional Surfaces
Contact: I. Rodríguez



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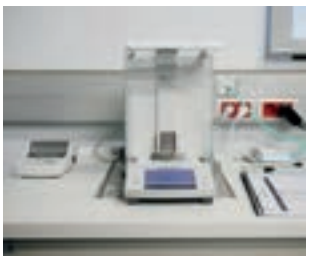
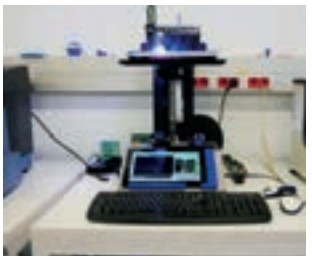
Laboratory of Catalitic Surfaces Spectroscopy in Controlled Atmosphere
Contact: M. A. Niño



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

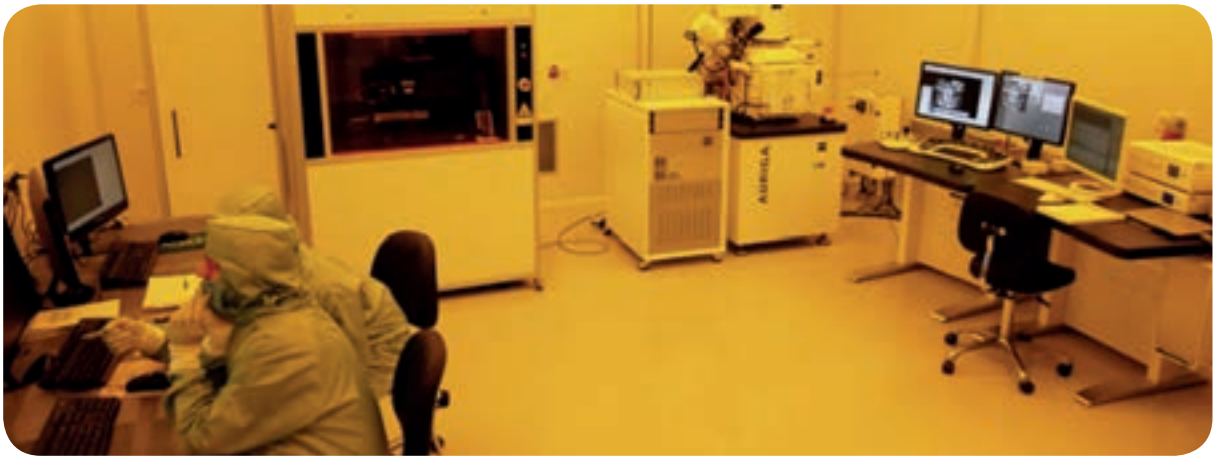
2. Center for nanofabrication

Prof. Daniel Granados
Director

RESEARCH STAFF
Dr. Manuel Rodriguez
Dr. María Acebrón
Andrés Valera

rla red de laboratorios Sistema madri+d

N° registro: 363



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 200m^2 of clean room surface and more than 500m^2 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 it´s own foundations and services (acclimatization units, electrical power lines, water drains, earthings, gas lines, gas exhaust lines, etc.). This clean room is equipped with the 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 60m^2 and has a certified air quality of ISO-5 (Class-100). The temperature is kept constantat 22±0.5º C 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 140m^2 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 Scriber, 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 fo 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 researches and users within the Cantoblanco campus of the UAM and in the framework of the Campus of Excellence project, with an efficient access to the necessary nanofabrication resources to be internationally competitive. Since IMDEA-Nanociencia is an institute created and financed jointly by the regional Government of Madrid and the Government of Spain, the Centre 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.

200m²
of clean room surface and more than 500m² in total

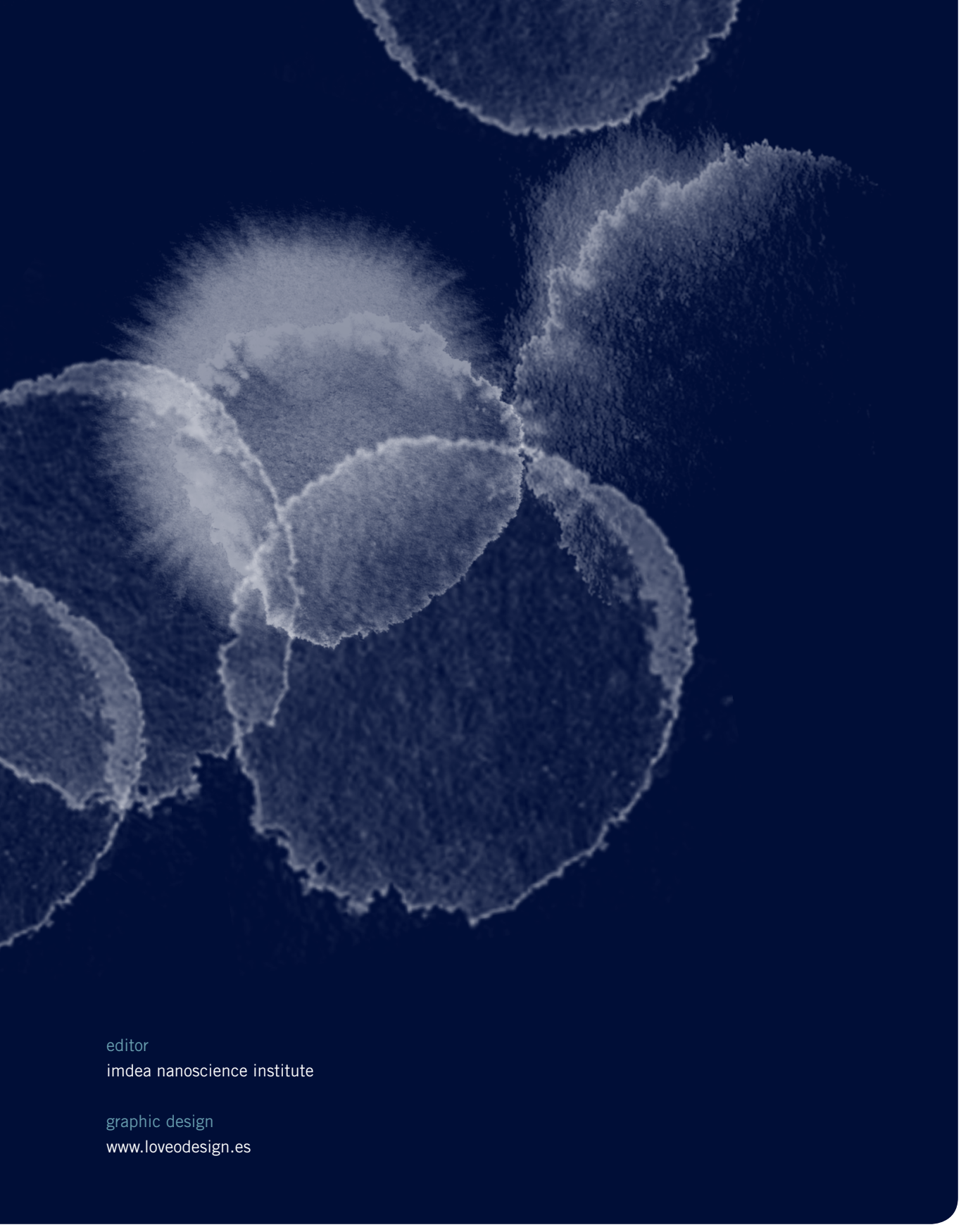
In 2009, I was offered a tenure-track position as a junior scientist at IMDEA-Nanociencia with the main objective of setting up from scratch the new nanofabrication facilities for the institute and CEI-UAM+CSIC. This involved looking for funds (2009-Now), design and construction of facilities (2009–2013), 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 CAB-INTA-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.

highlight



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graphic design
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