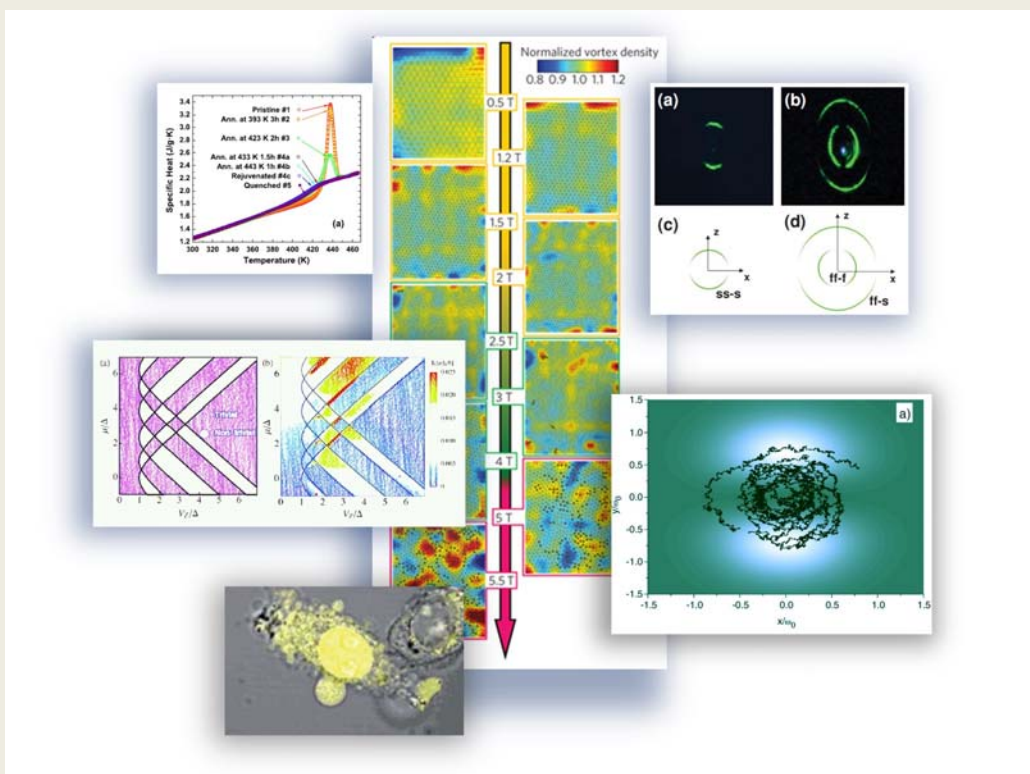


Instituto Universitario de Ciencia de Materiales Nicolás Cabrera

Activity report 2014



CONTENT

Welcome	5
Nicolás Cabrera Summer School	6
Colloquia	8
Science at INC	9
Young Researchers Meeting	18
Seminars and stays	20
Workshops	21
Prizes for Physics Students.....	22
Publications	23

Welcome

Dear reader:

This year we published our work in journals with a higher impact factor. Our papers can be accessed from our [web page](#). Rubén Perez and Jose María Gómez organized the 2014 Nicolás Cabrera Summer School, making an excellent job. [Fundación BBVA](#) finances the Summer School and organized the media coverage, with a press release and interviews to the speakers. The 2015 Summer School is organized by Farkhad Aliev, Julio Camarero and Juanjo Palacios. [Speakers](#) are confirmed and the school looks very promising again.

Thanks to our colloquia, we have been able to interact again with recognized scientists. Our PhD students discussed lively with them. Our undergraduate students made, again, very high quality [videos](#).

At the INC we bet on our students and youngest researchers. Our [Youtube channel](#), is fed by rudimentary work of very young students, and has 25% of the amount of visualizations than the [channel of IFT](#). More and more students visit our webpage and know about our research. This reinforces our main activity, the N. Cabrera Summer School. The collaboration of BBVA Foundation represents the support of our society to our research. The INC is an efficient instrument to manage such collaborations.

BBVA Foundation has been also important for several members of our Institute. [Pedro Tarazona](#) received the Medal of our Royal Physical Society in May 2014, sponsored by FBBVA. An ancient member of INC, Alberto Amo, received the prize in experimental physics. Other members of the INC, Andrés Castellanos and Isabel Guillamón received in December 2014 support for [their research from FBBVA](#). The latter is, remarkably, the only Spaniard (and only physicist in Europe) to obtain a prestigious project of the [AXA Foundation](#).

Past week end I installed a [Nest](#) thermostat at home. The designers of this devices show that we do not need to invent new things to innovate. Execution and empathy are most important. Empathy with the user and excellent execution have been the signatures of the work made in the research support system of UAM. We are now seeing changes in this system, with new webpages in [SEGAINVEX](#) and in [SIDI](#). The new nanofabrication facility of the excellence Campus in [Imdea Nanociencia](#) is starting operations. On the other hand, we have developed interesting initiatives as [IFIMAC](#), with huge potential. We need more than ever services that support efficiently our research work and improve its impact, by developing empathy with the user. This is probably our greatest challenge in near future. The success of our bet largely depends on the development of these services.

Hermann Suderow

Director of the INC

Nicolás Cabrera Summer School

The Nicolás Cabrera Summer School takes place since 1994, with the support of the program "Frontiers of science and technology" of the [BBVA Foundation](#) since 2002.



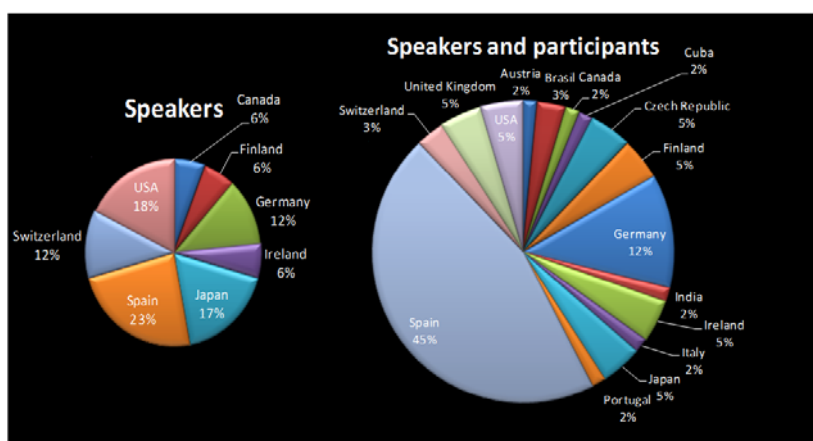
BBVA made a press release and a video you can see [here](#).

The 2014 Summer School, entitled "New Frontiers in Scanning Force Microscopy: from Ultrahigh-Vacuum to Biological Material" was directed by Rubén Pérez and José María Gómez-Rodríguez, and held from 14-18 July 2014 in Miraflores de la Sierra. The main objective of the School was to provide a comprehensive vision of modern experimental techniques in force microscopy, from cryogenic and ultra high vacuum conditions to the needed environment to study biological material. Latest theoretical advances were also discussed. The School gathered internationally recognized speakers that direct most innovative research groups world wide.

The School worked through the following themes:

- New advances in experimental scanning force microscopy
- Single molecule applications in liquids: DNA packing, virus assembly, etc...
- High resolution imaging with scanning force microscopy under UHV or liquids
- Simultaneous scanning force/scanning tunneling microscopy
- Theory in scanning force microscopy

The school filled our residence "[La Cristalera](#)" with more than 70 participants. More than half of the participants were doctoral students from different parts of the world (see figure).



The talks covered topical subjects, and speakers were available for discussions with students the whole week. Ambience, as always, was relaxed and students could interact with speakers in numerous informal meetings. New collaborations were set-up thanks to the school.

Students took active part in all discussions, frequently asking speakers during the talks. Three poster sessions were organized after the talks, Monday, Tuesday and Thursday.

Participants evaluated the event through personal interviews. They particularly valued the “1+1” format, i.e. one hour lecture during the morning, where speakers explained in detail the techniques used, and one hour lecture during the afternoon of the same day, where speakers explained applications of these techniques in particular problems or their research. Speakers explained many details, largely unknown by many participants. This would have been impossible in another framework.

Poster session was also very lively, with 32 posters that were presented to invited speakers and other participants. The speakers elected three posters, which received special prizes for their work.

Speakers list:

Michael Crommie (Berkeley, USA)

Óscar Custance (Tsukuba, Japan)

Adamn Foster (Helsinki, Finland)

Takeshi Fukuma (Kanazawa, Japan)

Ricardo García (Madrid, Spain)

Franz Giessibl (Regensburg, Germany)

Leo Gross (Rüschlikon, Switzerland)

Peter Grutter (Montréal, Canada)

Suzanne Jarvis (Dublin, Ireland)

Ernst Meyer (Basel, Switzerland)

Stephen Jesse (Oak Ridge, USA)

José Ignacio Pacual (San Sebastian, España)

Alexander Schwarz (Hamburg, Germany)

Udo Schwarz (New Haven, USA)

Hirofumi Yamada (Kyoto, Japan)



Group photo of the 2014 Summer School.

Colloquia

During 2014 we continued with the colloquia "Frontiers in Condensed Matter Physics", thanks to the collaboration of FBBVA. The colloquia are dedicated to the memory of Professor Nicolás Cabrera. This year, we received Paul C. Canfield (Ames), with the talk "*A chance to grow: Design, discovery, growth and characterization of novel compounds*", Leo Kouwenhoven (Delft), with the talk "*The quest for Majorana fermions*" T. M. Klapwijk (Delft) who spoke about "*How mesoscopic superconductivity is changing astronomical observation*" and A.P. Mackenzie (Dresden), who explained "*Electronic liquid crystals*". UAM students and Young researchers value positively the colloquia, which will be continued during 2015. Some talks are available in [Youtube](#).

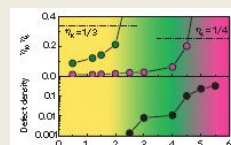


Science at INC

All papers can be found in our web page. In the following we mention some publications which we have found remarkable, because of the journal or the theme.

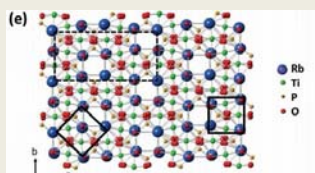
Enhancement of long-range correlations in a 2D vortex lattice by an incommensurate 1D disorder potential, I. Guillamón, R. Córdoba, J. Sesé, J. M. De Teresa, M. R. Ibarra, S. Vieira, H. Suderow, *Nature Physics* **10**, 851, (2014).

Long-range correlations in two-dimensional (2D) systems are significantly altered by disorder potentials. Theory has predicted the existence of disorder-induced phenomena, such as Anderson localization or the emergence of a Bose glass. More recently, it has been shown that when disorder breaks 2D continuous symmetry, long-range correlations can be enhanced.



Blue SHG Enhancement by Silver Nanocubes Photochemically Prepared on a RbTiOPO_4 Ferroelectric Crystal, L. Sanchez-Garcia, Mariola O. Ramirez, P. Molina, et al., *Advanced Materials* **26**, 6447, (2014).

Metallic nanoparticles are of enormous interest for a wide range of scientific and technologic applications such as chemical and biological sensors, surface-enhanced spectroscopies, photodetection and light harvesting and optical nanodevices.

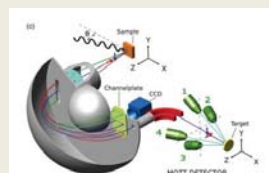


ADVANCED MATERIALS

Enantiospecific Spin Polarization of Electrons Photoemitted Through Layers of Homochiral Organic Molecules, M. A. Niño, I. A. Kowalik, F.J. Luque, et al., *Advanced Materials* **26**, 7474, (2014).

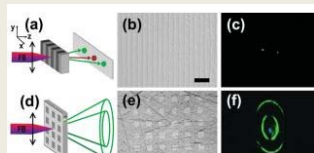
The long sought-after connection between the symmetry lowering associated with enantiomerically pure chiral organic molecules and electron spin polarization is demonstrated by spin-resolved photoemission experiments.

ADVANCED MATERIALS



BaMgF₄: An Ultra-Transparent Two-Dimensional Nonlinear Photonic Crystal with Strong $\chi(3)$ Response in the UV Spectral Region, L. Mateos, M. Ramirez, I. Carrasco, et al., *Advanced Functional Materials* **24**, 11, 1509, (2014).

Ferroelectric patterning is often used in advanced photonics and optoelectronic devices to increase their operational bandwidth and functionality, providing novel and unique performances. However, the extension of the ferroelectric structures to two-dimensional geometries is currently limited to very few oxides and phosphates systems, which constrains its current and future applications.

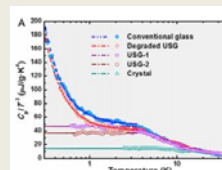


ADVANCED FUNCTIONAL MATERIALS

Suppression of tunneling two-level systems in ultrastable glasses of indomethacin, T. Pérez-Castañeda, C. Rodríguez-Tinoco, J. Rodríguez-Viejo, M. A. Ramos, *PNAS* **111**, 11275, (2014).

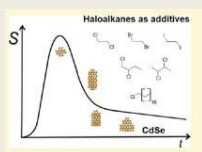
Glasses and other noncrystalline solids exhibit thermal and acoustic properties at low temperatures anomalously different from those found in crystalline solids, and with a remarkable degree of universality. Below a few Kelvin, these universal properties have been successfully interpreted using the tunneling model, which has enjoyed (almost) unanimous recognition for decades.

PNAS



Shape Evolution of CdSe Nanoparticles Controlled by Halogen Compounds, M. Meyns, F. Iacono, C. Palencia, et al., *Chemistry of Materials* **26**, 5, 1813, (2014).

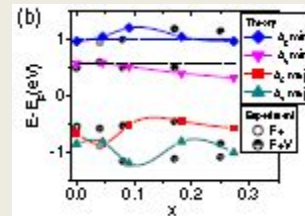
Halogen compounds are capable of playing an important role in the manipulation of nanoparticle shapes and properties. In a new approach, we examined the shape evolution of CdSe nanorods to hexagonal pyramids in a hot-injection synthesis under the influence of halogenated additives in the form of organic chlorine, bromine and iodine compounds.



cm CHEMISTRY OF MATERIALS

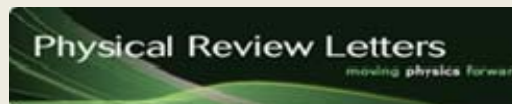
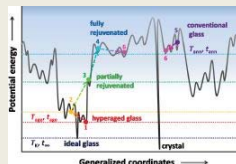
Band-Edge Noise Spectroscopy of a Magnetic Tunnel Junction, F. G. Aliev, J.P. Cascales, Physical Review Letters, 112, 21680, (2014).

We propose a conceptually new way to gather information on the electron bands of buried metal-(semiconductor-) insulator interfaces. The bias dependence of low frequency noise in Fe_{1-x}V_x/MgO/ Fe (0 < x < 0.25 tunnel junctions shows clear anomalies at specific applied voltages, reflecting electron tunneling to the band edges of the magnetic electrodes.



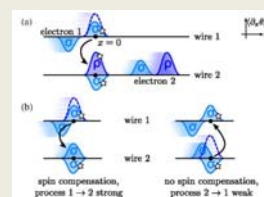
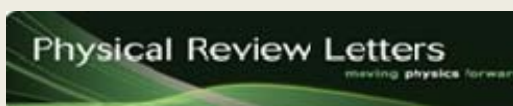
Two-level systems and boson peak remain stable in 110-million-year-old amber glass, T. Pérez-Castañeda, R.J.Jimenez-Rioboo, M.A. Ramos, Physical Review Letters 112, 165901, (2014).

The two most prominent and ubiquitous features of glasses at low temperatures, namely the presence of tunneling two-level systems and the so-called boson peak in the reduced vibrational density of states, are shown to persist essentially unchanged in highly stabilized glasses, contrary to what was usually envisaged. Specifically, we have measured the specific heat of 110 million-year-old amber samples from El Soplao (Spain), both at very low temperatures and around the glass transition T_g .



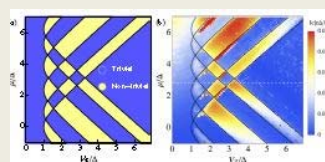
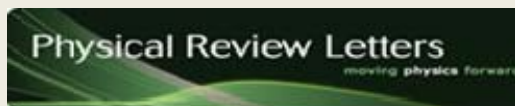
Detection of Spin Entanglement via Spin-Charge Separation in Crossed Tomonaga-Luttinger Liquids, A. Schroer, B. Braunecker, A. Levy Yeyati, et al., Physical Review Letters, 113, 266401, (2014).

We investigate tunneling between two spinful Tomonaga-Luttinger liquids (TLLs) realized, e.g., as two crossed nanowires or quantum Hall edge states. When injecting into each TLL one electron of opposite spin, the dc current measured after the crossing differs for singlet, triplet, or product states



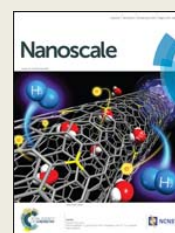
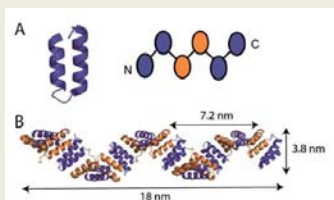
Mapping the Topological Phase Diagram of Multiband Semiconductors with Supercurrents, P. San-José, E. Prada, R. Aguado, *Physical Review Letters*, **112**, 137001, (2014).

Cell-surface receptors are the most common target for therapeutic drugs. The design and optimization of next generation synthetic drugs require a detailed understanding of the interaction with their corresponding receptors.



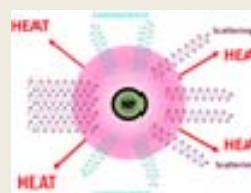
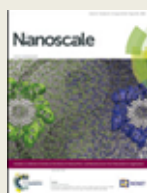
Controlled nanometric fibers of self-assembled designed protein scaffolds., A. Ferrier, S-H. Mejias, B. Sot, R. Guantes, A.L. Cortajarena, *Nanoscale*, **6**, 10982, (2014).

The use of biological molecules as platforms for templating and nanofabrication is an emerging field. Here, we use designed protein building blocks based on small repetitive units (consensus tetratricopeptide repeat – CTPR) to generate fibrillar linear nanostructures by controlling the self-assembly properties of the units.



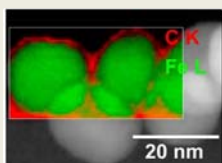
Nanoparticles for photothermal therapies, D. Jaque, L. Martínez Maestro, B. del Rosal, P. Haro-Gonzalez, A. Benayas, J. L. Plaza, E. Martín Rodríguez, J. García Solé, *Nanoscale* **6**, 9494, (2014).

The current status of the use of nanoparticles for photothermal treatments is reviewed in detail. The different families of heating nanoparticles are described paying special attention to the physical mechanisms at the root of the light-to-heat conversion processes. The heating efficiencies and spectral working ranges are listed and compared. The most important results obtained in both in vivo and in vitro nanoparticle assisted photothermal treatments are summarized.



Modulation of Magnetic Heating via Dipolar Magnetic Interactions in Monodisperse and Crystalline Iron Oxide Nanoparticles, G. Salas; J. Camarero; D. Cabrera; et al, *Journal of Physical Chemistry C* **118**, 34, 19985, (2014).

In the pursuit of controlling the heat exposure mediated by magnetic nanoparticles, we provide new guidelines for tailoring magnetic relaxation processes via dipolar interactions. For this purpose, highly crystalline and monodisperse magnetic iron oxide nanocrystals whose sizes range from 7 to 22 nm were synthesized by thermal decomposition of iron organic precursors in 1-octadecene.

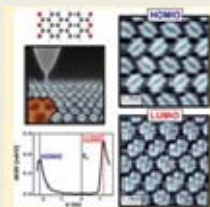


THE JOURNAL OF
PHYSICAL CHEMISTRY C

Imaging Molecular Orbitals of PTCDA on Graphene on Pt(111): Electronic Structure by STM and First-Principles Calculations, A. J. Martínez-Galera, N. Nicoara, J.I. Martínez; et al, *Journal of Physical Chemistry C* **118**, 12782, (2014).

The adsorption and growth of 3,4,9,10-perylene tetracarboxylic dianhydride (PTCDA) on graphene monolayers epitaxially grown on Pt(111) surfaces is studied by a combination of experimental scanning tunneling microscopy (STM) and spectroscopy (STS) measurements and first-principles density functional theory (DFT) calculations

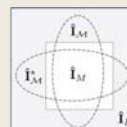
THE JOURNAL OF
PHYSICAL CHEMISTRY C



Theory of projections with nonorthogonal basis sets: Partitioning techniques and effective Hamiltonians, M. Soriano, J. J. Palacios, *Physical Review B*, **90**, 075128, (2014).

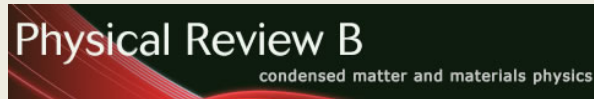
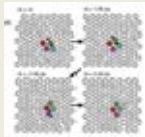
Here, we present a detailed account of the fundamental problems one encounters in projection theory when nonorthogonal basis sets are used for representation of the operators. In particular, we reexamine the use of projection operators in connection with the calculation of projected (or reduced) Green's functions and associated physical quantities such as the local density of states (LDOS), local charge, and conductance.

Physical Review B
condensed matter and materials physics



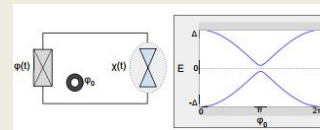
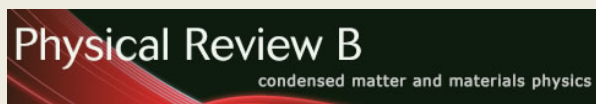
Quasiparticle trapping, Andreev level population dynamics, and charge imbalance in superconducting weak links, A. Zazunov, A. Brunetti, A. Levy Yeyati, R. Egger, *Physical Review B*, **90**, 104508, (2014)

We study a one-dimensional interacting electronic liquid coupled to a 1D array of classical magnetic moments and to a superconductor. We show that at low energy and temperature the magnetic moments and the electrons become strongly entangled and that a magnetic spiral structure emerges.



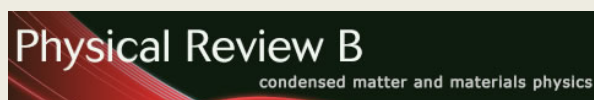
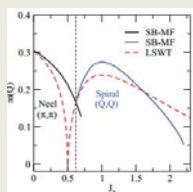
Atomic mechanisms and diffusion anisotropy of Cu tetramers on Cu(111), J. Ferron, R. Miranda, J.J. de Miguel, *Physical Review B*, **90**, 125437, (2014).

The surface diffusion of compact Cu tetramers on Cu(111) has been studied at the atomic scale by means of molecular dynamics simulations using embedded atom interatomic potentials. The Cu clusters diffuse by several different mechanisms; all of them have the common trait of involving concerted displacements of at least some of the atoms forming the island.



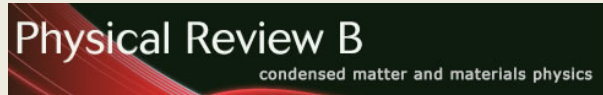
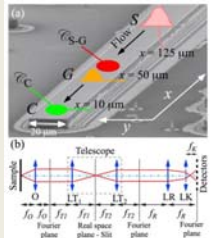
Spin-liquid phase in a spatially anisotropic frustrated antiferromagnet: A Schwinger boson mean-field approach, J. Merino, M. Holt, B.J. Powell, *Physical Review B* **89**, 245112, (2014).

We explore the effect of the third-nearest neighbors on the magnetic properties of the Heisenberg model on an anisotropic triangular lattice. We obtain the phase diagram of the model using Schwinger boson mean-field theory. Competition between Neel, spiral, and collinear magnetically ordered phases is found as we vary the ratios of the nearest J_1 , next-nearest J_2 , and third-nearest J_3 neighbor exchange couplings.



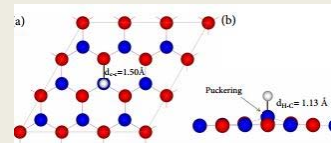
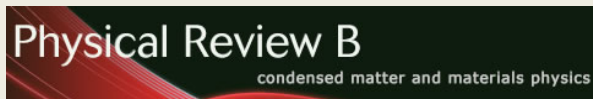
Operation speed of polariton condensate switches gated by excitons, C. Antón, T.C.H. Liew, D. Sarkar, M.D. Martín, Z. Hatzopoulos, P.S. Eldridge, P.G. Savvidis, L. Viña, *Physical Review B*, **89**, 235312, (2014).

We present a time-resolved photoluminescence (PL) study in real and momentum space of a polariton condensate switch in a quasi-one-dimensional semiconductor microcavity. The polariton flow across the ridge is gated by excitons inducing a barrier potential due to repulsive interactions.



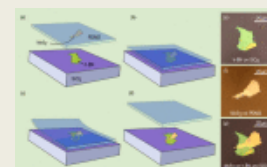
Hydrogenation-induced ferromagnetism on graphite surfaces, Mohammed Moaied, J. V. Alvarez, and J. J. Palacios, *Physical Review B*, **90**, 115441, (2014).

We calculate the electronic structure and magnetic properties of hydrogenated graphite surfaces using van der Waals density functional theory (DFT) and model Hamiltonians. We find, as previously reported, that the interaction between hydrogen atoms on graphene favors adsorption on different sublattices along with an antiferromagnetic coupling of the induced magnetic moments



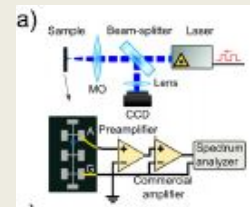
Single-layer MoS₂ roughness and sliding friction quenching by interaction with atomically flat substrates, J. Quereda, A. Castellanos-Gomez, N. Agrait, G. Rubio-Bollinger, *Applied Physics Letters* **105**, 053111 (2014).

We experimentally study the surface roughness and the lateral friction force in single-layer MoS₂ crystals deposited on different substrates: SiO₂, mica, and hexagonal boron nitride (h-BN). Roughness and sliding friction measurements are performed by atomic force microscopy.



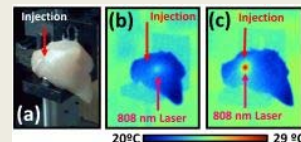
Transient lateral photovoltaic effect in patterned metal-oxide-semiconductor films, J.P. Cascales, I. Martínez, D. Díaz, J.A. Rodrigo, F.G. Aliev, *Applied Physics Letters* **104**, 231118, (2014).

The time dependent transient lateral photovoltaic effect has been studied with fs time resolution and with chopping frequencies in the kHz range, in lithographically patterned 21 nm thick, 5, 10, and 20 μm wide, and 1500 μm long Co lines grown over naturally passivated p-type Si (100). We have observed a nearly linear dependence of the transitorial response with the laser spot position.



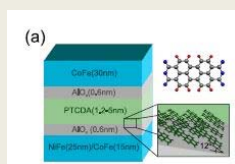
Nd^{3+} doped LaF_3 nanoparticles as self-monitored photo-thermal agents, U. Rocha, K. Upendra Kumar, C. Jacinto, J. Ramiro, A. J. Caamaño, J. García Soñe, D. Jaque, *Applied Physics Letters* **104**, 053703, (2014).

In this work, we demonstrate how LaF_3 nanoparticles activated with large concentrations (up to 25%) of Nd^{3+} ions can simultaneously operate as biologically compatible efficient nanoheaters and fluorescent nanothermometers under single beam (808 nm) infrared laser excitation. $\text{Nd}^{3+}:\text{LaF}_3$ nanoparticles emerge as unique multifunctional agents that could constitute the first step towards the future development of advanced platforms capable of simultaneous deep tissue fluorescence bio-imaging and controlled photo-thermal therapies.



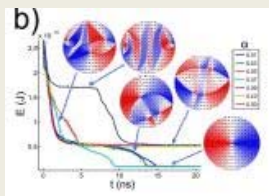
Superpoissonian shot noise in organic magnetic tunnel junctions, J.P. Cascales, Jhen-Yong Hong, I. Martínez, M.T. Lin, T. Szczepanski, V.K. Dugaev, J. Barnas, F.G. Aliev, *Applied Physics Letters*, **105**, 233302, (2014)

Organic molecules have recently revolutionized ways to create new spintronic devices. Despite intense studies, the statistics of tunneling electrons through organic barriers remains unclear. Here, we investigate conductance and shot noise in magnetic tunnel junctions with 3,4,9,10-perylene-teracarboxylic dianhydride (PTCDA) barriers a few nm thick. For junctions in the electron tunneling regime, with magnetoresistance ratios between 10% and 40%, we observe superpoissonian shot noise.



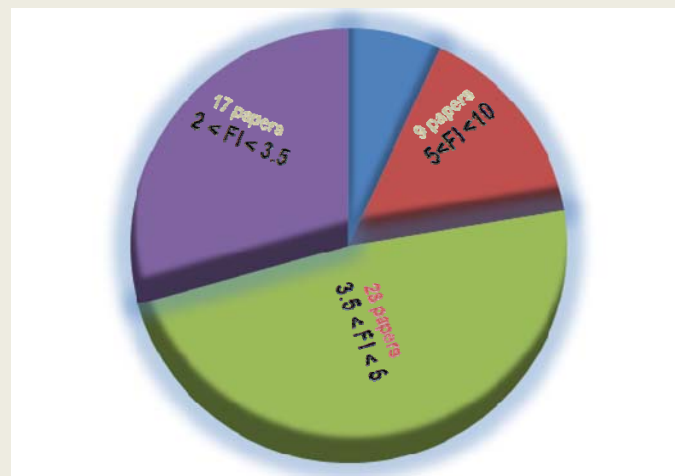
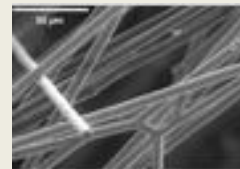
Magnetization reversal assisted by half antivortex states in nanostructured circular cobalt disks, A. Lara, O.V. Dobrovolskiy, J.L. Prieto, M. Huth, F.G. Aliev, Applied Physics Letters, 105, 182402 (2014).

The half antivortex, a fundamental topological structure which determines magnetization reversal of submicron magnetic devices with domain walls, has been suggested also to play a crucial role in spin torque induced vortex core reversal in circular disks. Here, we report on magnetization reversal in circular disks with nanoholes through consecutive metastable states with half antivortices.



Critical findings during the optimisation of hydrogen storage in vapour grown carbon fibres, D. Martin y Marero, A. Madronero, International Journal of Hydrogen Energy 39, 23, 12690, (2014).

The storage of hydrogen in vapour grown carbon fibres samples, according to different well known manufacturing processes, is studied. The main differences between the samples are: the precursor gases composition; the application of an annealing treatment in different atmospheres; charging by absorption in a high pressure hydrogen atmosphere; and finally, chemical and electrochemical treatments.



Distribution of papers in journals as a function of the journal impact factor

Young Researchers Meeting



The Young researchers meeting 2014 took place in December in La Cristalera, with the participation of doctoral students of the Institute. During the meeting, the INC gave the prize “Young researchers prize in materials science” to Tomás Pérez Castañeda for his work “Two-Level Systems and Boson Peak Remain Stable in 110-Million-Year-Old Amber Glass” made in collaboration with the INC member Miguel Ángel Ramos, and published in *Physical Review Letters* 112, 165901 (2014).

The INC also gave Laura Sánchez García a special mention for his work “Blue SHG Enhancement by Silver Nanocubes Photochemically Prepared on a RbTiOPO₄ Ferroelectric Crystal” made in collaboration with the INC member Luisa Bausá López. The jury was named by the Board of the INC and was composed of Professors P. Tarazona, J.M. Calleja and J.V. Álvarez. The jury met on 9th December 2014 and proposed unanimously the winners to the board, taking into account the rules of the prize. The jury analyzed in detail the documents presented by the candidates and took the quality of the work and the scientific prestige of the journal where the work was published. The jury also took into account that the candidate was the first author.

The jury congratulates all participants for the outstanding scientific quality of their work.



Los conferenciantes invitados, T. Pérez Castañeda (derecha) y L.Sánchez con los premios otorgados durante la jornada.

During the meeting, we organized a posters session and heard the following talks:

- *"Interaction Between Localized Surface Plasmons and Rare-Earth Ion Based Solid-State Gain Media"* Eduardo Yraola, (Departamento de Física de Materiales).
- *"Channel waveguide fabrication technique in KY(WO4)2 combining liquid-phase-epitaxy and beam-multiplexed fs-laser writing"*. Jon Martinez (Departamento de Física de Materiales).
- *"Study of the growth and interaction of Co oxides on oxide substrates"*, Daniel Díaz Fernández (Departamento de Física Aplicada).
- *"Biosensing platforms based on the plasmon resonance of gallium nanodroplets"*, Antonio García Marín, (Departamento de Física Aplicada).
- *"Porous silicon: from biological functionalization to optoelectronic nanocomposites"*, Dario Gallach Pérez (Departamento de Física Aplicada).
- *"Effect of long-range spatial correlations on the lifetime statistics of an emitter in a two-dimensional disordered lattice"*, Nuno de Sousa, (Departamento de Física de la Materia condensada).
- *"Superconducting properties and vortex lattice in b-Bi2Pd"*, Edwin Herrera Vasco, (Departamento de Física de la Materia Condensada).
- *"Entanglement detection in coupled particle plasmons"*, Javier del Pino, (Departamento de Física Teórica).
- *"Non-stationary and noise properties of molecular junctions in the polaronic regime"*, Ruben Seoane Soto, (Departamento de Física Teórica).
- *"Micro and Nanofabrication at the CEI UAM+CSIC"*, Daniel Granados, (IMDEA Nanoiencia).

Seminars and stays

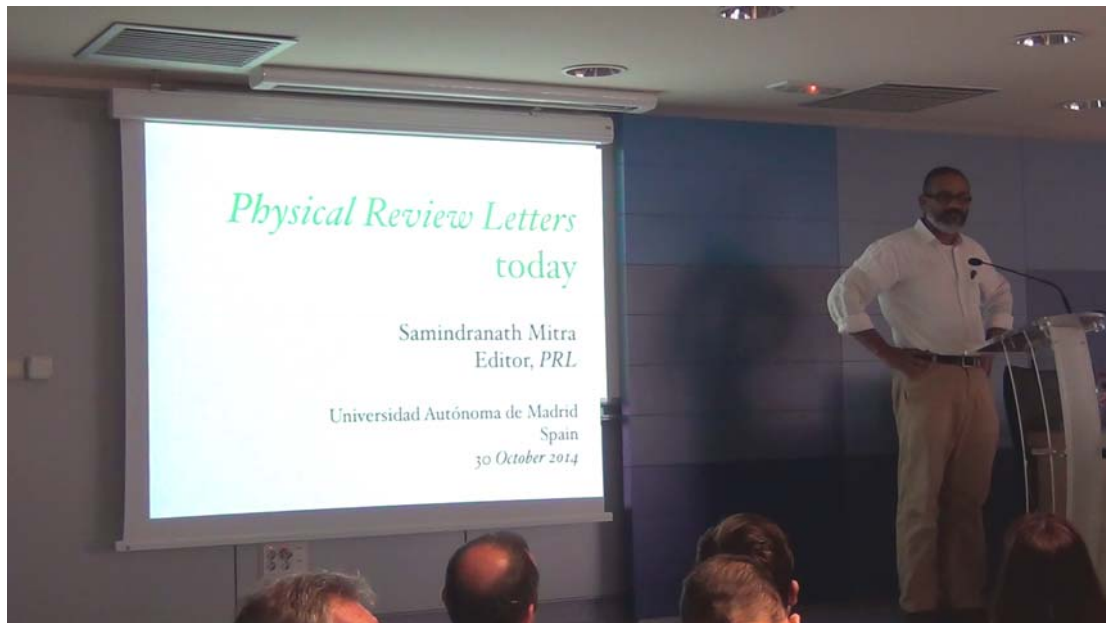
During 2014 we celebrated the following seminars:

Friday, 28 February 2014, “NbSe₂: a prototype strong-coupling charge density wave materials”, Jasper van Wezel.

Wednesday, 10 September 2014 “Fluorescent and photovoltaic SiC: a new research field”, Mikael Syväjärvi, Linköping, Institut Neel -CNRS and Université Joseph Fourier, Grenoble, France

Thursday 30 November 2014, “PRL today”, Samindranath Mitra, Editor, Physical Review Letters.

We also enjoyed the visit to our laboratories of four students of the University of Rzeszow (Poland). The students were financed by the program “Nano-modern” of Rzeszow University and worked with Profs Nicolás Agraït, Amadeo Vázquez, Jose Emilio Prieto and Hermann Suderow. They participated in some activities of the Master in Condensed Matter Physics and Biosystems.



Workshops

From 4 to 7 May the workshop “Advances in nanostructured superconductors: materials, properties and theory” was organized in the La Cristalera residence. More than 50 participants, experts in the physics of superconductors, gathered in the workshop, which was financed within the program [COST MP1201](#), “Nanoscale superconductivity, novel functionalities for novel applications”.



Prizes for Physics Students

The INC gave seven undergraduate students prizes for their work during summer 2014. Students worked during three months in some of the research groups of the Institute. They learned about our research and produced a video explaining the research line where they have been working. Their work is available in [Youtube](#). Some of these students continue their work in our research groups. The INC gave three students a special mention, for the quality of the work. Students and their tutors have been:

- [Acero Gonzalez](#), Sergio, tutor Alfredo Levy Yeyati: special mention "Sources of Entangled Electrons in Nano Devices".
- [Bailen Martínez](#), Francisco Javier, tutor José Vicente Álvarez, special mention "Simulaciones de primeros principios en Física de la Materia Condensada".
- [Sánchez Barquilla](#), Mónica, tutor Enrique Velasco, "La Física de los sistemas biológicos: un enfoque computacional".
- [Barrena Escolar](#), Victor tutor Elsa Prada, special mention "Superconductores topológicos y el fermión de Majorana".
- [Sánchez Barquilla](#), Raquel, tutor Isabel Guillamón, "Campos magnéticos elevados: una herramienta necesaria en física de la materia condensada".
- [García Corral](#), Alvaro, tutor Nicolás Agraït, "Manipulación de moléculas mediante técnicas de microscopía de efecto túnel STM realizadas en condiciones ambientes".
- [Lee Miguel](#), Frank, tutor Hermann Suderow, "Crystallography".



Publications

R. Vincent, H. Marinchio, J.J. Saenz, et al.

Local control of the excitation of surface plasmon polaritons by near-field magneto-optical Kerr effect.

Physical Review B, **90**, 24, 241412, (2014).

U. Buchenau, R. Zorn M.A. Ramos

Probing cooperative liquid dynamics with the mean square displacement.

Physical Review E, **90**, 4, 042312, (2014)

C. Anton, D. Solnyshkov, G. Tosi, et al.

Ignition and formation dynamics of a polariton condensate on a semiconductor microcavity pillar.

Physical Review B, **90**, 15, 155311, (2014).

D. Diaz Fernandez, J. Mendez, F. Yubero, et al.:

Study of the early stages of growth of Co oxides on oxide substrates

Surface and Interface Analysis, **46**, 10-11, 975 (2014)

A.K. Novak, M.D. Martin, H.P. van der Meulen, et al:

Single photon emission dynamics of InP-InGaP quantum dots under p-shell excitation
EPL, **108**, 1, 17002, (2014)

Miztli Yopez, J.J. Saenz.

Contribution of evanescent waves to the effective medium of disordered waveguides.

EPL **108**, 1, 17006, (2014).

J. Ferron, R. Miranda, J.J. de Miguel:

Atomic mechanisms and diffusion anisotropy of Cu tetramers on Cu(111)
Physical Review B, **90**, 12, 125437, (2014).

L. Medero, E. Velasco, Y.

Martínez Ratón *Hard-body models of bulk liquid crystals.*

Journal of Physics-Condensed Matter **26**, 46, 463101 (2014)

A. Lara, O.V.

Dobrovolskiy, J.L. Prieto, et al: *Magnetization reversal assisted by half antivortex states in nanostructured circular cobalt disks.*

Applied Physics Letters **105**, 18, 182492 (2014)

I. Guillaumon; R.Córdoba; J. Sese et al:

Enhancement of long-range correlations in a 2D vortex lattice by an incommensurate 1D disorder potential.

Nature Physics, **10**, 851, (2014).

L. Sanchez-Garcia, Mariola O. Ramirez, P. Molina; et al:

Blue SHG Enhancement by Silver Nanocubes Photochemically Prepared on a RbTiOPO₄ Ferroelectric Crystal.

Advanced materials **26**, 37, 6447, (2014).

M.T. Gonzalez, X. Zhao, D. Zsolt Manrique; et al *Structural versus Electrical*

Functionalization of Oligo(phenylene ethynylene) Diamine Molecular Junctions.

Journal of Physical Chemistry C **118**, 37, 21655, (2014)

A. Zazunov; A. Brunetti, A. Levy Yeyati; et al:

Quasiparticle trapping, Andreev level population dynamics, and charge imbalance in superconducting weak links.

Physical Review B **90**, 10, 104508, (2014)

Manuel I. Marqués:

Beam configuration proposal to verify that scattering forces come from the orbital part of the Poynting vector.

Optics Letters **39**, 17, 5122, (2014)

G. Salas, J. Camarero, D. Cabrera; et al:

Modulation of Magnetic Heating via Dipolar Magnetic Interactions in Monodisperse and Crystalline Iron Oxide Nanoparticles.

Journal of Physical Chemistry C **118**, 34, 19985, (2014).

C. Janani, J. Merino, I. P. McCulloch, et al:

Haldane Phase in the Hubbard Model at 2/3-Filling for the Organic

Molecular Compound Mo3S7(dmit)3.
Physical Review Letters
113, 267204, (2014)

C. Anton, G. Tosi; M. D. Martin, et al: *Quantum coherence in momentum space of light-matter condensates*.
Physical Review B **90**, 081407, (2014)

M. Soriano, J.J. Palacios, *Theory of projections with nonorthogonal basis sets: Partitioning techniques and effective Hamiltonians*.
Physical Review B **90**, 075128, (2014)

D. Martin y Marero, A. Madronero: *Critical findings during the optimisation of hydrogen storage in vapour grown carbon fibres*.
International Journal of Hydrogen Energy **39**, 12690, (2014).

J. Quereda, A. Castellanos-Gomez, N. Agrait; et al: *Single-layer MoS2 roughness and sliding friction quenching by interaction with atomically flat substrates*.
Applied Physics Letters **105**, 5, 053111, (2014).

A.L. Sanz, D. G. Míguez: *Dual R-Smads interplay in the regulation of vertebrate neurogenesis*.
Neurogenesis **1**, e29529 (2014).

S.H. Mejias; B. Sot; R. Guantes, et al.: *Controlled nanometric fibers of self-assembled designed protein*

scaffolds.
Nanoscale, **6**, 10982, (2014)

T. Pérez-Castañeda, C. Rodríguez-Tinoco, J. Rodríguez-Viejo, et al: *Suppression of tunneling two-level systems in ultrastable glasses of indomethacin*.
PNAS **111**, 11275 (2014).

M. Trevisani, K.V. Ivanovskikh, M.O. Ramirez, et al: *VUV-UV 5d-4f interconfigurational transitions of Nd3+ in BaMgF4 ferroelectric crystals*.
Journal of Luminescence **153**, 136, (2014).

D. Jaque, L. Martinez Maestro, B. del Rosal, et al: *Nanoparticles for photothermal therapies*
Nanoscale **6**, 9494, (2014)

I. Guillamón, H. Suderow, P. Kulkarni, et al: *Nanostructuring superconducting vortex matter with focused ion beams*
Physical C-Superconductivity and its Applications **503**, 70, (2014).

N. de Sousa, J.J. Saenz, A. García Martín, et al: *Effect of long-range spatial correlations on the lifetime statistics of an emitter in a two-dimensional disordered*
Physical Review A **89**, 063830, (2014).

J. Merino, O. Gunnarsson: *Pseudogap and singlet formation in organic and cuprate superconductors*,
Physical Review B **89**, 245130, (2014)

J.A. Galvis, L. Chirolli, I. Guillamon, et al: *Zero-bias conductance peak in detached flakes of superconducting 2H-TaS2 probed by scanning tunnelingspectroscopy*.
Physical Review B **89**, 224512, (2014).

J. Merino, M. Holt, Ben J. Powell: *Spin-liquid phase in a spatially anisotropic frustrated antiferromagnet: A Schwinger boson mean-field approach*.
Physical Review B **89**, 24, 245112, (2014).

H. Suderow, I. Guillamón, J.G. Rodrigo, et al: *Imaging superconducting vortex cores and lattices with a scanning tunneling microscope*.
Superconductor Science & Technology, **27**, 063001, (2014).

Y. Martinez-Raton, V. Szabolcs, E. Velasco: *Phase behaviour of liquid-crystal monolayers of rod-like and plate-like particles*.
Journal of Chemical Physics, **140**, 204906, (2014)

F. G. Aliev, J.P. Cascales *Band-Edge Noise Spectroscopy of a Magnetic Tunnel Junction*.

Physical Review Letters
112, 216801, (2014).

J. P. Cascales, I. Martínez, D. Díaz , et al: *Transient lateral photovoltaic effect in patterned metal-oxide-semiconductor films* Applied Physics Letters **104**, 231118, (2014)..

M. Holt, B.J. Powell, J. Merino: *Spin-liquid phase due to competing classical orders in the semiclassical theory of the Heisenberg model with ring exchange on an anisotropic triangular lattice.* Physical Review B, **89**, 174415, (2014).

H. Santos, D. Soriano, J.J. Palacios: *Anomalous exchange interaction between intrinsic spins in conducting graphene systems* Physical Review B, **89**, 195416, (2014).

L. Mateos, L.E. Bausa, O. Mariola: *Micro-spectroscopic characterization of ferroelectric domain structures in Yb³⁺:LiNbO₃ prepared by electron beam writing.* Optical Materials express, **4**, 1077, (2014).

R. Galindo, N.Menendez, P. Crespo, et. al: *Comparison of different methodologies for obtaining nickel nanoferrites.* Journal of Magnetism and Magnetic Materials, **361**, 118, (2014).

D. Diaz- Fernández, J. Mendez, M.O. Bomati, et al: *The growth of cobalt oxides on HOPG and SiO₂ surfaces: A comparative study.* Surface Science, **624**, 145, (2014)

T. Pérez-Castañeda, R.J.Jimenez-Rioboo, M.A. Ramos: *Two-level systems and boson peak remain stable in 110-million-year-old amber glass.* Physical Review Letters, **112**, 165901, (2014).

P. San-José, E. Prada, R. Aguado: *Mapping the Topological Phase Diagram of Multiband Semiconductors with Supercurrents.* Physical Review Letters, **112**, 137001, (2014).

L. Mateos, M. Ramirez, I. Carrasco, et al: *BaMgF₄: An Ultra-Transparent Two-Dimensional Nonlinear.* Advanced Functional Materials **24**, 1509, (2014).

M. Meyns, F. Iacono, C. Palencia, et al: *Shape Evolution of CdSe Nanoparticles Controlled by Halogen Compounds.* Chemistry of Materials **26**, 1813, (2014).

P. Gonzalez de Prado Salas, I. Hoeger, F. Martín García, et al: *Torsion and curvature of FtsZ filaments.* Soft Matter, **10**, 12, 1977, (2014).

R. Seoane Souto, A. Levy Yeyaty, A. Martín Rodero, et al: *Dressed tunneling approximation for electronic transport through molecular transistors.* Physical Review B, **89**, 085412, (2014).

T. Stauber: *Plasmonics in Dirac systems: from graphene to topological insulators* Applied Journal of Physics-Condensed Matter, **26**, 123201, (2014).

A. Kumar, M. Gaim, D. Steininger, et ál: *Temperature dependence of Andreev spectra in a superconducting carbon nanotube quantum dot.* Surface Physical Review B, **89**, 075428, (2014).

LM. Laura, P. Haro-Gonzalez, A. Sanchez Iglesias, et al: *Quantum Dot Thermometry Evaluation of Geometry Dependent Heating Efficiency in Gold Nanoparticles* Langmuir, **30**, 1650, (2014).

U. Rocha, D. Uprendra Kumar, C. Jacinto, et al: *Nd³⁺ doped LaF₃ nanoparticles as self-monitored photo-thermal agents.* Applied Physics Letters, **104**, 053703, (2014).

T. Stauber, G. Gómez-Santos, FJG. de Abajo: *Extraordinary Absorption of Decorated Undoped Graphene.*

- Physical Review Letters, **112**, 077401, (2014).
- G. Dominguez-Cañizares, A. Gutierrez, J. Chaboy, et al:** *Effects of grain refinement and disorder on the electronic properties of nanocrystalline NiO.* Journal of Materials Science, **49**, 2773, (2014).
- S. Varga, Y. Martínez-Ratón, E. Velasco:** *Hard rods in a cylindrical pore: the nematic-to-smectic phase transition.* Journal of Physics-Condensed Matter, **26**, 075204, (2014).
- O. Bomati-Miguel, N. Miguel-Sancho, I. Abasolo, et al.:** *Ex vivo assessment of polyol coated-iron oxide nanoparticles for MRI diagnosis applications: toxicological and MRI contrast enhancement effects.* Journal of Nanoparticle research, 2292 **16**, (2014).
- H. Marinchio, R. Carminati, A. García-Matín et al:** *Magneto-optical Kerr effect in resonant subwavelength nanowire gratings.* New journal of Physics, **16**, 015007, (2014).
- E.Z. Fratzczak, J.E. Prieto, M.E. Moneta:** *Growth and characterization of epitaxial iron-nitride thin films.* Journal of Alloys and Compounds **586**, 375, (2014).
- K. Fladischer, A. Politano, W.E. Emst, et al:** *A helium atom scattering study of well-ordered TCNQ adlayers on Cu(100).* Surface Science **620**, 65, (2014).
- J.P. Cascales, Jhen-Yong Hong, I. Martinez et al:** *Superpoissonian shot noise in organic magnetic tunnel junctions.* Applied Physics Letters **105**, 233302 (2014).
- A. Lara, V. Metlushko, M. García.Hernández, et al:** *Spin Waves Along the Edge States.* Spin, **4**, 1, (2014).
- A. Schroer, B. Braunecker, A. Levy, et al:** *Detection of Entanglement via Spin-Charge Separation in Crossed Tomonaga-Luttinger Liquids.* Physical Review Letters, **113**, 266401, (2014).
- D. Olivares, A. Levy Yeyati, L. Bretheau, et al:** *Dynamics of quasiparticle trapping in Andreev levels.* Physical Review B, 104504, (2014).
- A. Gómez Martínez, F. Márquez, E. Elizarde, et al:** *Microspheres for the Growth of Silicon Nanowires via Vapor-Liquid-Solid.Mechanism.* Journal of Nanomaterials, 362798, (2014).
- M.Moaied, J.V. Álvarez, J.J. Palacios:** *Hydrogenation-induced ferromagnetism on graphite surfaces.* Physical Review B, **90**, 115441, (2014).
- A. Castellanos-Gómez, L. Vicarelli, E. Prada, et al:** *Isolation and characterization of few-layer black phosphorus.* 2D Materials, **1**, 025001, (2014).
- C. Antón, T.C.H. Liew, D. Sarkar, et al:** *Operation speed of polariton condensate switches gated by excitons.* Physical Review B, **89**, 235312, (2014).
- M.A. Niño, I.A. Kowalik, F.J. Luque, et al:** *Enantiospecific Spin Polarization of electrons Photoemitted Through Layers of Homochiral Organic Molecules.* Advance Materials **26**, 7474, (2014).
- J.E. Prieto, I. Markov:** *Step energies and equilibrium shape of strained monolayer islands.* Europhysics Letters, **108**, 46007, (2014).



Board:

Director: Hermann Suderow.
Deputy Director: Alfredo Levy Yeyati.
Scientific secretary: Herko van der Meulen.

Secretary: Manuela Moreno.

Comisión de Dirección:

Board: Luisa Bausá, Pablo Pernas, Jaime Merino Troncoso y José Vicente Álvarez Carrera.

We thank:

Antón Fente Hernández, Edwin Herrera and Jose Benito Llorens for their work in taking videos and uploading them.

Carlos Antón y Rubén Seoane for the organization of the young researchers meeting.

To the Organizers of seminars and of the workshop within the [COST program](#).

To the La Cristalera personnel, directed by Ana Martínez. In this occasion, we wish to thank especially Sandra Herranz, for her great work, availability and kindness.

The design of the announcements of the colloquia is made by [Pablo Matera and Eduardo Ramos](#). [Eugenio Hernández Barcala](#) is charged of our web page and will Help us renovate the webpage during 2015. [Josu Gastón](#) has reprinted the papers of Prof. Nicolás Cabrera, and produced an [interactive](#) book.



Campus Internacional
excelencia UAM
CSIC+

