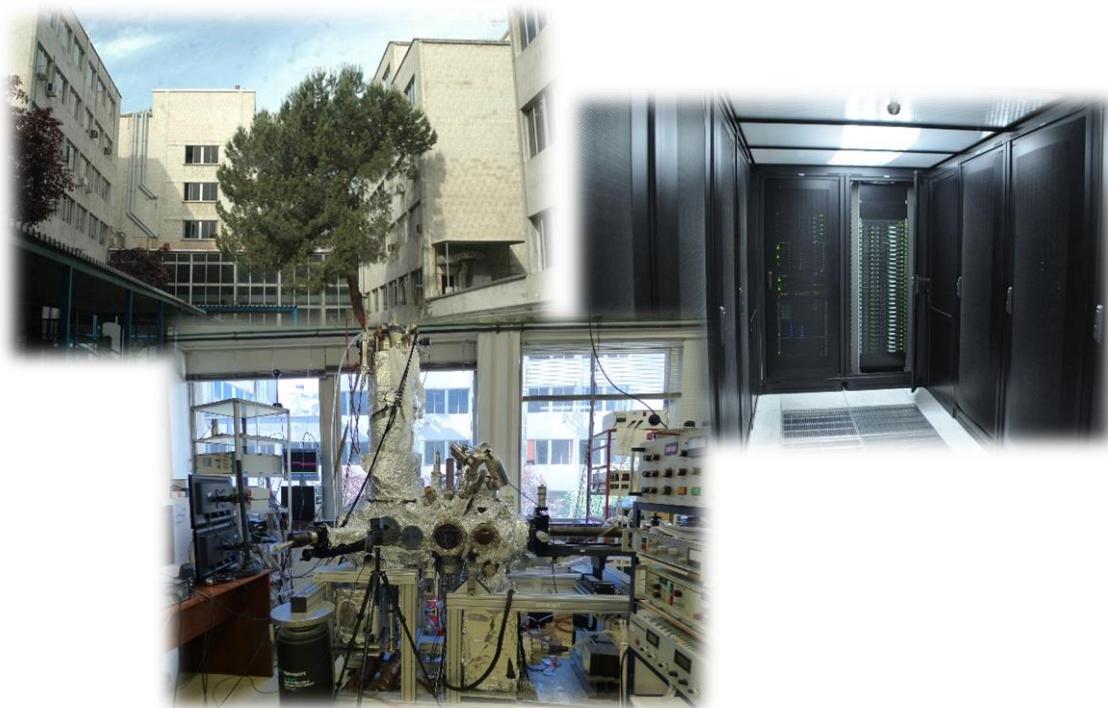


CONDENSED MATTER PHYSICS CENTER (IFIMAC)



2022 ACTIVITY REPORT



Universidad Autónoma
de Madrid

IfiMAC
Condensed Matter Physics Center



EXCELENCIA
MARÍA
DE MAEZTU

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1. OUR CENTER

1.1 Letter from the Director

Welcome to the annual report of the Condensed Matter Physics Center (IFIMAC). Established in 2012, IFIMAC's mission is pursuing cutting-edge research and scientific excellence in this broad field, at the crossroads of Physics, Chemistry, Materials Science and Biology, fostering a truly multidisciplinary approach. In 2022, we have celebrated our tenth anniversary with the IFIMAC day. These ten years have consolidated IFIMAC as a Spanish center of reference in the field, with an internationally recognized research program that spans from Quantum Materials and Technologies, Nano and Quantum optics, and Nanotechnology, to Soft and Active Matter and Biophysics.

During this year, we have made significant progress along several strategic lines, defined by the new Steering Committee in October 2021, in order to complete our current "Maria de Maeztu research unit of excellence" (MdM) project and to prepare for the next call, due in early 2023. Among them, we highlight: (i) the hiring of three technicians to support our experimental and computational activities and our outreach efforts, together with (ii) the improvement of our current research infrastructure with common experimental and computational facilities, and (iii) the refurbishment of some office spaces to accommodate the new hirings of PhD student and post-doctoral researchers. These initiatives, started in 2022, will be fully completed in 2023.

IFIMAC membership is awarded to individual researchers, based on the scientific excellence achieved at the different levels of the academic career. IFIMAC had 83 members in 2022, including 65 permanent research and teaching staff from our host institution, the Universidad Autónoma de Madrid (UAM), and 18 young researchers associated with different programs of international talent attraction. These young researchers are supported by national (10 Ramón y Cajal contracts), regional (3 Atracción de Talento Comunidad de Madrid (AT-CM) modalidad 1 fellows) and private (3 Junior Leader La Caixa grants) programs, as well as by an assistant professorship from UAM and our own MdM funds (1 young international research leader).

We are particularly proud of this last initiative, that offers brilliant international young researchers a four-year contract, lab space and funding to develop their own research groups. The three young researchers attracted with the previous 2014-2018 MdM grant secured Ramón y Cajal contracts and have become permanent staff at UAM. Two of them have been awarded ERC starting grants. The three recruitments with the current 2019-2022 MdM project have also got Ramón y Cajal contracts in the last two calls (one of them declined in favor of an AT-CM fellowship). Apart from its members, IFIMAC hosted in 2022 the research activity and training of 34 post-doctoral researchers (53% of them, non-spaniards), and 118 PhD students. They contribute significantly to the achievement of the IFIMAC's mission.

Our research outcome in 2022 consolidates the total number of articles (198) --with a small reduction in the publication in top-cited journals with respect to the previous year, 80,3% (58.6%) in Q1-- 56,6% (24.7%) in D1 according to Scopus (WoS)--, and a significant increase in patent applications (7). IFIMAC researchers have been

particularly successful in the attraction of funding in 2022 (a 29\% increase with respect to 2021), with 119 active projects representing a total budget of 8.9 million € (20.4 % EU). Together with this external funding, the seven collaborative projects, supported by past and current MdM funds, have played a key role in fostering synergies among IFIMAC researchers. The two currently active collaborative projects, "Disorder as a novel platform for topological superconductivity" and "Dynamically driving spinning colloidal particles in 2D lattices", expand the boundaries of two areas of intense activity, topological properties and active matter, in which IFIMAC has a unique position and great potential.

These research activities are complemented by the IFIMAC's involvement in training and outreach. We directly promote the Master in Physics of Condensed Matter and the Biological Systems (<https://www.masternanobio.es>) and the PhD Program in Physics of Condensed Matter, Nanoscience and Biophysics (<http://doctorate-nanobio-uam.es>), and are involved in another three master and three doctoral programs at UAM. Our outreach activities cover from lectures for primary and high schools to promote STEM studies and scientific careers in the areas covered by IFIMAC, to the development of a very successful series of videos, in collaboration with the Youtube channel QuantumFracture , approaching our latest research to society. Under the orientation of our gender committee, these activities have been strongly focused on reducing the underrepresentation of women in STEM fields, particularly acute in the case of Condensed Matter Physics. Two key activities started in 2022 are (i) the mentoring program for female physics students (with 34 female mentees and 34 mentors --with no gender restriction--), and (ii) the development of a series of videos that showcase the research activity of IFIMAC from the perspective of some of our young female researchers, supported by a grant from FECYT.

I invite you to explore this annual report. Through its pages, you will discover IFIMAC's reality. Looking into the future, IFIMAC has a great potential to go beyond its already remarkable achievements. We are already working on some important initiatives, like a change in our legal status and a brand-new building with top-class lab space, that will contribute to boost our research activity and knowledge transfer in the coming years.

Ruben Perez
IFIMAC Director

1.2 Overview

The IFIMAC – Condensed Matter Physics Center is a María de Maeztu Excellence Research Unit. The Center got the first María de Maeztu Excellence accreditation (MDM-20140377) on the 2014 call and it was renewed in 2018 (CEX2018-000805-M).

The Condensed Matter Physics Center is a Research Center within UAM, located in the campus of the Universidad Autónoma de Madrid pursuing cutting-edge research and scientific excellence. It comprises researchers from several university departments aiming to advance the limits of knowledge in both theoretical and experimental Condensed Matter Physics. Sixty seven researchers constitute its permanent staff with seventeen young researchers (RyC, talent grant, Junior leader, IFIMAC positions) and up to one hundred and fifty postdoctoral researchers and Ph.D students.

Research performed in the institute has gained world reputation in the following areas:

- Advanced Materials
- First Principles Simulations and Modeling
- Nanophysics
- Nano and Quantum Optics
- Soft Condensed Matter and Biophysics

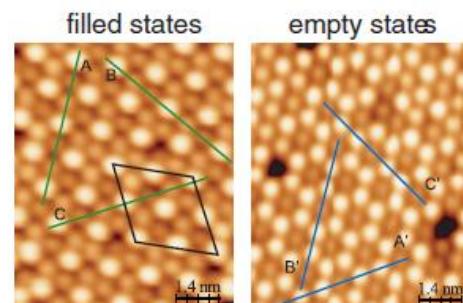
1.3 Research lines

Research developed in the IFIMAC since it was set up in 2012 is organized in the following areas. Here we describe relevant general aspects of each line in the past years:

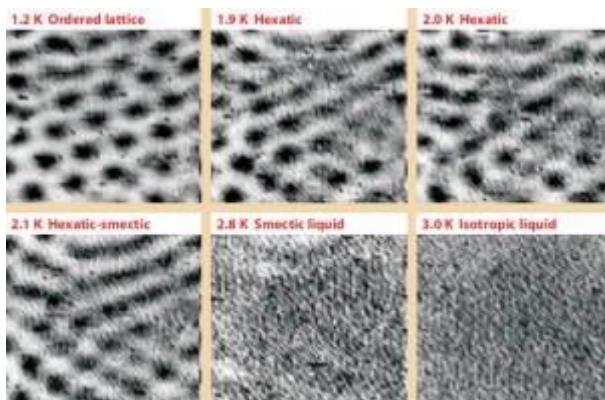
Advanced materials

Advanced materials are responsible in a large part for the continuous transformation of our daily life technology. New graphene based materials with improved strength and fatigue resistance open possibilities for transport industry, organic molecular devices allow optical applications for communications, superconductors improve energy efficiency and storage, and interfaces provide radically new operational principles for information treatment and storage.

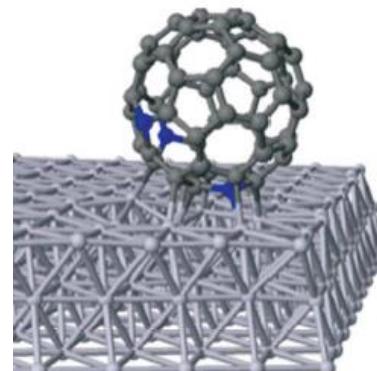
IFIMAC makes fundamental studies of the properties of materials with the aim to set the pace for future transformational changes in technology. For this, we carry an extensive research program in the synthesis, characterization and modeling of new materials. We develop state of the art instrumentation and techniques which we offer to other research groups through spin-offs or scientific collaborations.



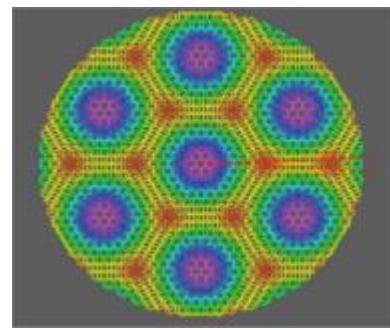
Among them are computational techniques or atomic manipulation as well as surface characterization techniques. Further experimental possibilities are given by support, characterization and nanofabrication facilities provided by the UAM. For example, engineers of the UAM operate the largest liquid helium production and recovery facility of our country (with over 50 000 liters / year), and provide a development center dedicated to the construction of new instrumentation. IFIMAC allows researchers to measure and characterize materials from atomic scale to large sizes, from low to high frequencies, at



Quantum calculations of interfaces and dynamical properties of surfaces are used to interpret experiments and make new predictions. In the IFIMAC, practically every new idea in materials science can be realized using state of the art tools.



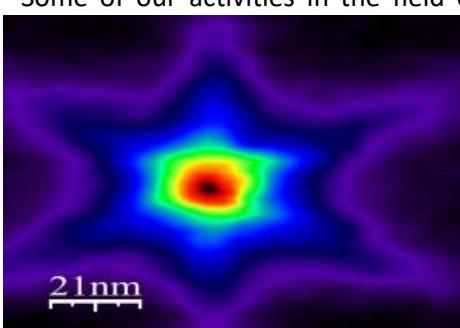
temperatures down to 7 mK and magnetic fields up to 13 T.



Regarding the material properties under study at IFIMAC, several groups are very active in the research on magnetism, superconductivity, spintronics and vortex physics. Other areas of expertise in our center are two-dimensional materials like graphene, in which we analyze in depth its mechanical properties and the role of defects and impurities. Within this area, we also investigate the exciting properties of topological insulators.

A very important topic is also the study of interfaces of organic semiconductors and the atomic, electronic and dynamical properties of semiconductors.

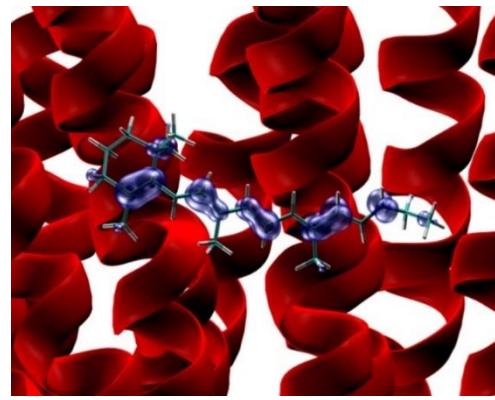
Some of our activities in the field of Advanced Materials are the study of quantum phase transitions, like superconductor-insulator or magnetic-non magnetic, and reversible phase transitions.



First Principles Simulations and Modeling

Computer modeling has grown over the years into a scientific discipline on its own. Models are utilized to assess real-world phenomena maybe too complex to be analyzed in the laboratory or under hypotheses at a fraction of the cost of undertaking the actual activities. Models in industry, government, and educational institutions shorten design cycles, reduce costs, and enhance knowledge.

In Physics, the modeling of materials through what is known as “first-principles” has become a major research field. By “first-principles” one understands the use of the fundamental quantum mechanical laws of nature and nothing else. The properties of the materials should emerge from the numerical solution of these laws. The models here are actually a faithful representation of reality, but in a controlled environment.



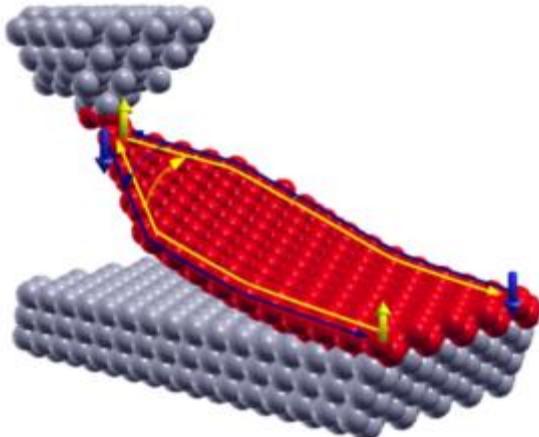
Researchers at IFIMAC have a long-standing and well-deserved international reputation on theoretical modeling and, in particular, on the development of efficient first-principles techniques for the simulation of the electronic and structural properties of complex materials. All the other research lines at IFIMAC benefit one way or another from this expertise. This knowledge not only benefits fundamental research, but can also be transferred directly into the society through spin-offs.

This is a list of codes and computational techniques being developed and implemented:

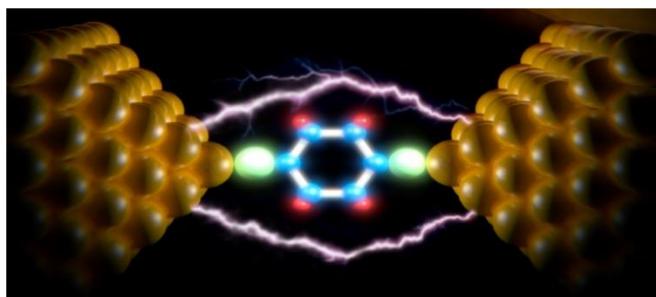
- SIESTA code for large-scale DFT simulations.
- ANT code for DFT-based electronic quantum transport calculations.
- FIREBALL code for DFT local-orbital molecular-dynamics.
- Hybrid Quantum Mechanics/Molecular Mechanics (QM/MM) method for the simulation of biomolecules.
- Non-adiabatic molecular dynamics.
- MOLCAS code for wave function theory electronic structure calculations.

Research topics:

- Molecular electronics.
- Bi-dimensional crystals.
- Interfaces of organic semiconductors
- Chemical reactions in biomolecules.
- Atomic, electronic, and dynamical properties of semiconductor surfaces.
- Nanowires and nanocontacts.
- Excited states off-element ions in solids.



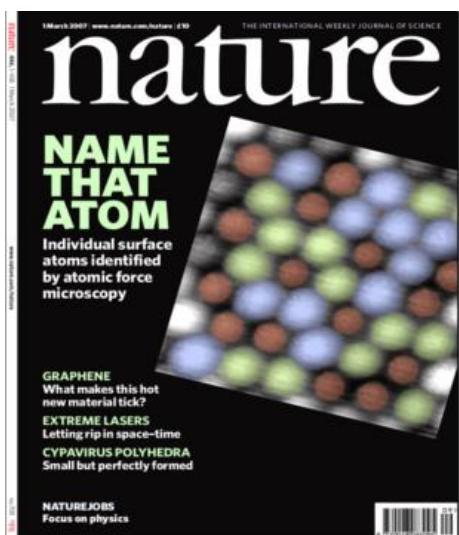
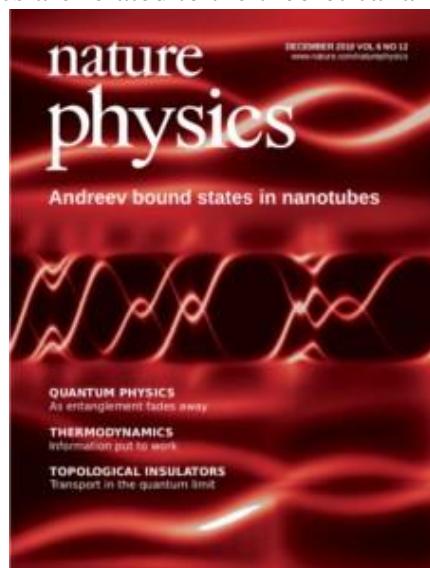
Nanophysics



technological applications. One of the main goals of researchers at IFIMAC is the study of the electronic, mechanical, thermal, and optical properties of structures and devices with nanometric dimensions, for which classical laws do not longer apply. For this purpose, we make use of a wide range of nanofabrication techniques, experimental probes, and theoretical tools.

Some of our main activities in the field of Nanophysics are related to the theoretical and experimental study of novel low-dimensional systems such as graphene and graphene-based nanostructures. Making use of experimental techniques such as Angle Resolved Photoemission Spectroscopy (ARPES) or Low Energy Electron Diffraction (LEED), IFIMAC researchers also investigate topics like 2D structural phase transitions, surface charge density waves, or the electronic structure of laterally nanostructured systems. Furthermore, we study the growth and properties of nanometer-scale objects on solid surfaces with applications in spintronics, optoelectronics, magnetic recording, nanoscale catalysis, nanomechanical biosensing, medical nanoimaging, etc.

When the characteristics dimensions of a system or a device are shrunk to the nanoscale, their properties change dramatically. The reason for that is that at this scale quantum mechanical effects set in, which leads to novel physical phenomena that, in turn, are often the basis of unforeseen



Other important areas of expertise in our center are the fields of Nanoelectronics and Quantum Transport. In particular, in recent years researchers at IFIMAC have played a leading role in the understanding of the electronic transport in a great variety of nanoscale systems such as metallic atomic-size contacts, single-molecule junctions, superconducting hybrid structures, or strongly correlated low-dimensional systems.

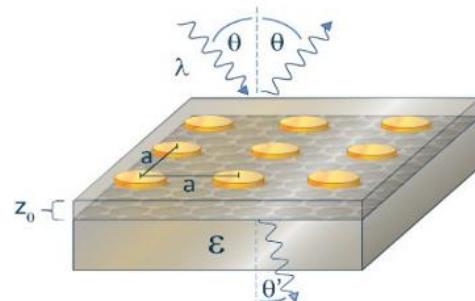
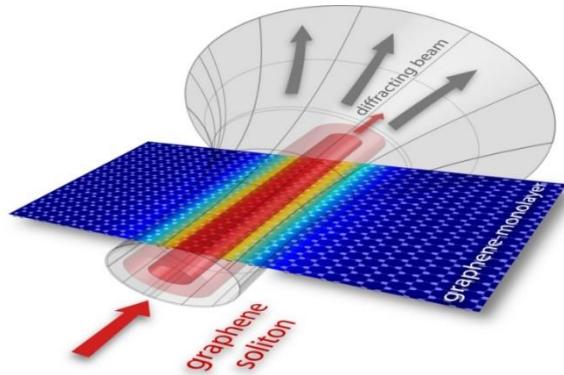
A very important topic in our center is also the use and modeling of Scanning Probe Microscopes (SPMs). Thus for instance, from an experimental point of view, Atomic Force Microscopy (AFM) is being currently used for instrumentation, physical virology, and for the study of mechanical and electrical properties of low-dimensional materials. Another key subject is the use of cryogenic Scanning Tunneling Microscopy (STM) for the surface characterization of semiconductor and superconductor

nanostructures. From a theoretical point of view, IFIMAC researchers are among the worldwide leaders in the area of ab initio modeling of nanowires and SPMs.

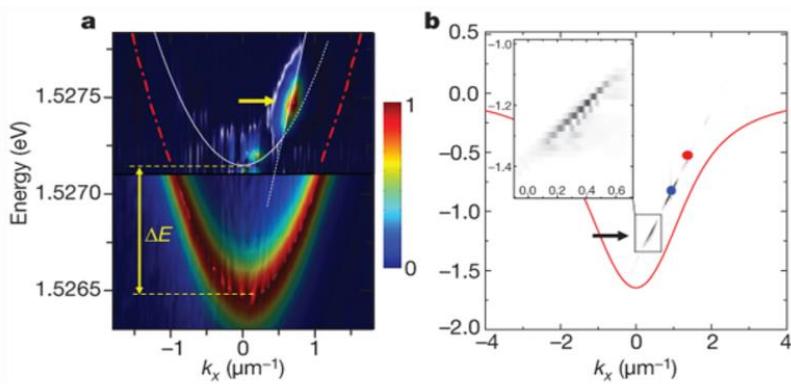
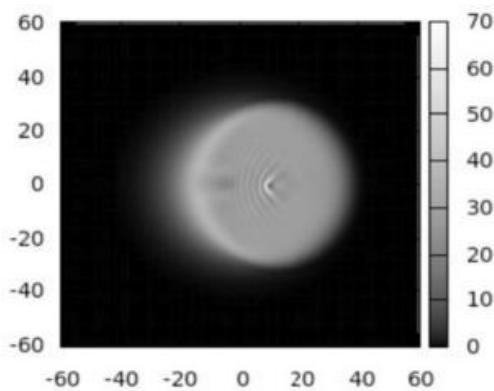
Nano and Quantum Optics

Nano Optics is the research domain devoted to the study of electromagnetic field propagation, confinement and interaction with matter at a sub-wavelength scale. Recent advances in fabrication and characterization techniques permit nowadays the study of optical phenomena at the nanoscale. Quantum optics is a related field of research, merging the areas of quantum field theory and optics, dealing with phenomena involving light and its interaction with matter at the quantum level. The field has evolved considerably from its early studies of coherence properties of radiation and parametric processes of light to recent topics of investigation such as quantum information, manipulation of single atoms, Bose-Einstein condensation, etc. The progress of quantum optics implies, from the scientific point of view, a deeper understanding of the foundations of quantum mechanics. From the applications side, it is expected to have a strong social and economic impact thanks to the build up of a revolutionary technology based on quantum phenomena.

Some of our main activities in this line of research are related to the emerging field of Plasmonics, which is the study of optical phenomena associated with the electromagnetic response of metals. The interface between a metal and a dielectric presents surface plasmons (surface electron density oscillations), which originate electromagnetic fields confined near the metal-dielectric interface, leading to exotic optical properties, like negative refraction. Researchers at IFIMAC have played a key role in the study of the phenomenon of extraordinary optical transmission through subwavelength apertures. Also within Plasmonics, we have made important contributions in the field of plasmon-assisted transport in atomic-scale junctions and the propagation of electromagnetic waves in magneto-plasmonic nanostructures.



Another very active subject in IFIMAC is the analysis of non-conservative optical forces on small particles. From the study of basic fundamental aspects to different applications to the manipulation of nanoparticles by optical tweezers and also pushing and pulling nanoparticles by radiation pressure or light-induced modification of the Brownian motion of particles in suspension. Light-matter interaction in two-dimensional systems, such as graphene and graphene-based heterostructures, graphene relatives, transition metal dichalcogenides and their combination in vertical stacks are also investigated at IFIMAC.



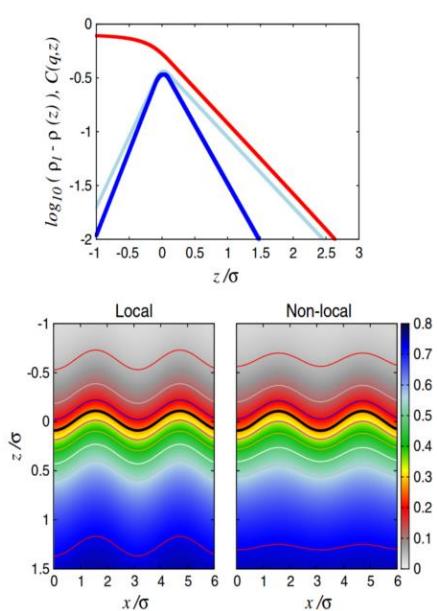
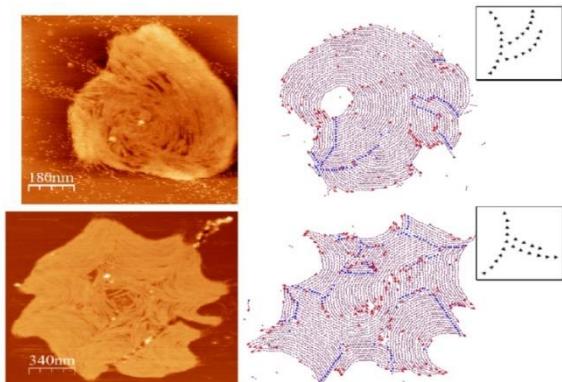
interacting bosonic complexes describing cavity polaritons pioneering works on the superfluidity and coherence properties of polariton gases both under resonant and non-resonant pumping. IFIMAC also has a strong activity in the field of ultracold atomic gases.

Experimental groups at IFIMAC have a long experience on optical spectroscopy of semiconductor low-dimensional systems. Currently we are working on quantum optics based on semiconductor quantum dots. Using photon correlation techniques, we have studied the properties of single photon emitters based on quantum dots of semiconductor systems both isolated and coupled to optical microcavities. By using time-resolved spectroscopy, we have presented the first experimental evidence on spin relaxation in doped quantum wells. We have also discovered exciton interactions strongly dependent on spin. In the last years IFIMAC researchers have focused on the study of quantum microcavities based on semiconductor nanostructures and on the preparation of Bose-Einstein condensates in solid-state systems.

On the other hand, theorists at IFIMAC have produced seminal contributions to the understanding of light emission and absorption spectra in low-dimensional semiconductor structures. We have worked in the quantum optics produced by and contributed with

Soft Matter and Biophysics

Soft condensed matter includes liquids, colloids, polymers, liquid crystals, gels, membranes, foams, etc. Each of these dense phases appears as the result of a finely tuned balance between the thermal fluctuations and the molecular attractions. The qualitatively different aspects and properties of soft condensed matter are very difficult to predict because it self organizes into mesoscopic physical structures that are much larger than the molecular scale, but yet are much smaller than the macroscopic scale of the material. Understanding the link between these scales, and the emergence of qualitatively new properties from the interactions of the molecular elements sets a fundamental problem in condensed matter physics.

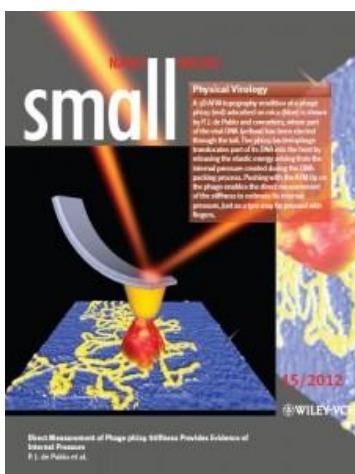


The amazing complexity of biological systems is built on that variety of soft condensed matter mesoscale structures, and it sets the most outstanding challenge in our goal to understand the spontaneous self-assembly of matter. The connection between soft condensed matter physics and the study of biological systems opens a broad and fructiferous route to the interdisciplinary field of biophysics, in which researchers with very different backgrounds, from molecular biology to theoretical physics and mathematics, are contributing to a fully new perspective of that active field of research.

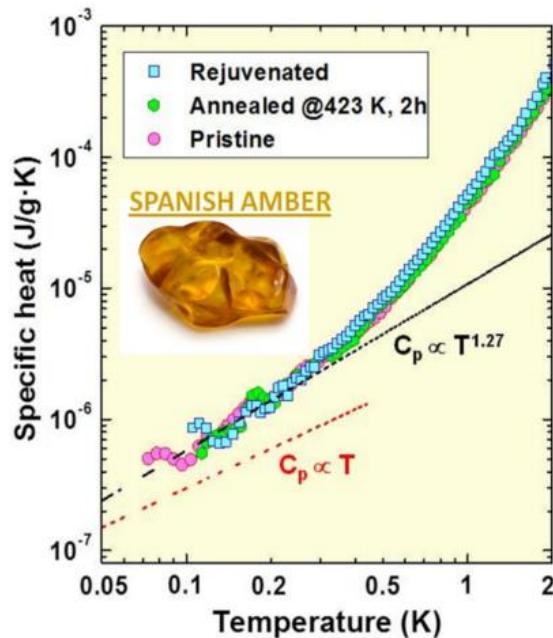
Soft condensed matter and biophysics are very active areas of activity at IFIMAC. The theory and simulations of liquids and their interfaces has already a long tradition among some of the members of the institute, with the younger researchers bringing new ideas and perspectives to cover more complex systems. Special simulation methods have been developed for the study to these systems out of equilibrium. Experimental and theoretical work on glasses has also been carried out for a long time, and it has recently being extended to the study of fossil amber samples and other ultra-stabilized glasses.

Among the multiple routes to biophysical systems, the experience of IFIMAC members in theoretical soft matter physics is being successfully used in different approaches to biological systems. First-principle simulations for the electronic structure of bio-molecules are being used to describe their chemical reactions. In a complementary top-down approach, the experience in the statistical physics of soft condensed matter system is been used to study bi-layer membranes and protein filaments, in close connection with experimental works. Younger members of the institute have incorporated new lines of biophysical research at IFIMAC, from genetic to neuronal networks, that open a fresh perspective based on the application of non-linear dynamics, the theory of stochastic processes and information theory.

Physical Virology

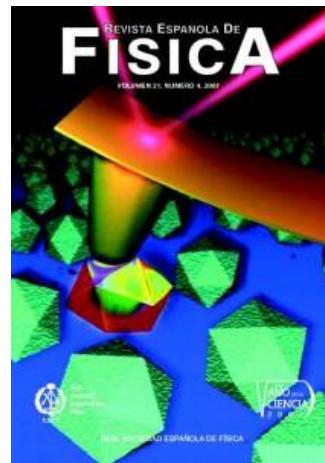


The basic architecture of a virus consists of the capsid, a shell made up of repeating protein subunits, packing within the viral genome. Far from being static structures, viruses are highly dynamic nucleoprotein complexes that transport and deliver their genome from host to host in a fully automatic process. Viral particles are endowed with specific physicochemical properties which confer to their structures certain meta-stability whose modulation permits fulfilling each task of the viral cycle at the right time.



These natural designed capabilities have impelled using viral capsids as protein containers of artificial cargoes (drugs, polymers, enzymes, minerals) with applications in biomedical and materials sciences. Both natural and artificial protein cages have to protect their cargo against a variety of physicochemical aggressive environments, including molecular impacts of highly crowded media, thermal and chemical stresses, and osmotic shocks.

Viral cages stability under these ambiences depend not only on the ultimate structure of the external capsid, which rely on the interactions between protein subunits, but also on the nature of the cargo. Thus, it is important to find methodologies that directly supply univocal information about protein cages stability not only under different environments, but also its evolution upon structural changes.



1.4 Organization/Management

Steering Committee



Rubén Pérez Pérez
IFIMAC Director

Full Permanent Professor at
Department of Theoretical
Condensed Matter Physics,
Universidad Autónoma de
Madrid.

Luisa E. Bausá López
IFIMAC Deputy
Director

Full Permanent Professor
at Materials Physics
Department, Universidad
Autónoma de Madrid.



Antonio Fernández-Domínguez
Member
Associate Professor
at Department of
Theoretical
Condensed Matter
Physics,
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I. Cristina Gómez-Navarro González
Member
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Felix Zamora Abanades
Member
Full Permanent
Professor at
Department of
Inorganic
Chemistry,
Universidad
Autónoma
de
Madrid.

Hermann Suderow
Infrastructure development
Full Permanent
Professor at
Department of
Condensed Matter
Physics,
Universidad
Autónoma de
Madrid.

Scientific Advisory Board

Prof. Paul C. Canfield

Researcher at Ames Laboratory (USA).

Prof. Daan Frenkel

Professor at University of Cambridge (United Kingdom).

Prof. Emilio Artacho

Research Professor at Ikerbasque at CIC Nanogune (Spain).

PhD. Fernando B. Cáceres

Chief Executive Officer at Endesa Gas T&D (Spain).

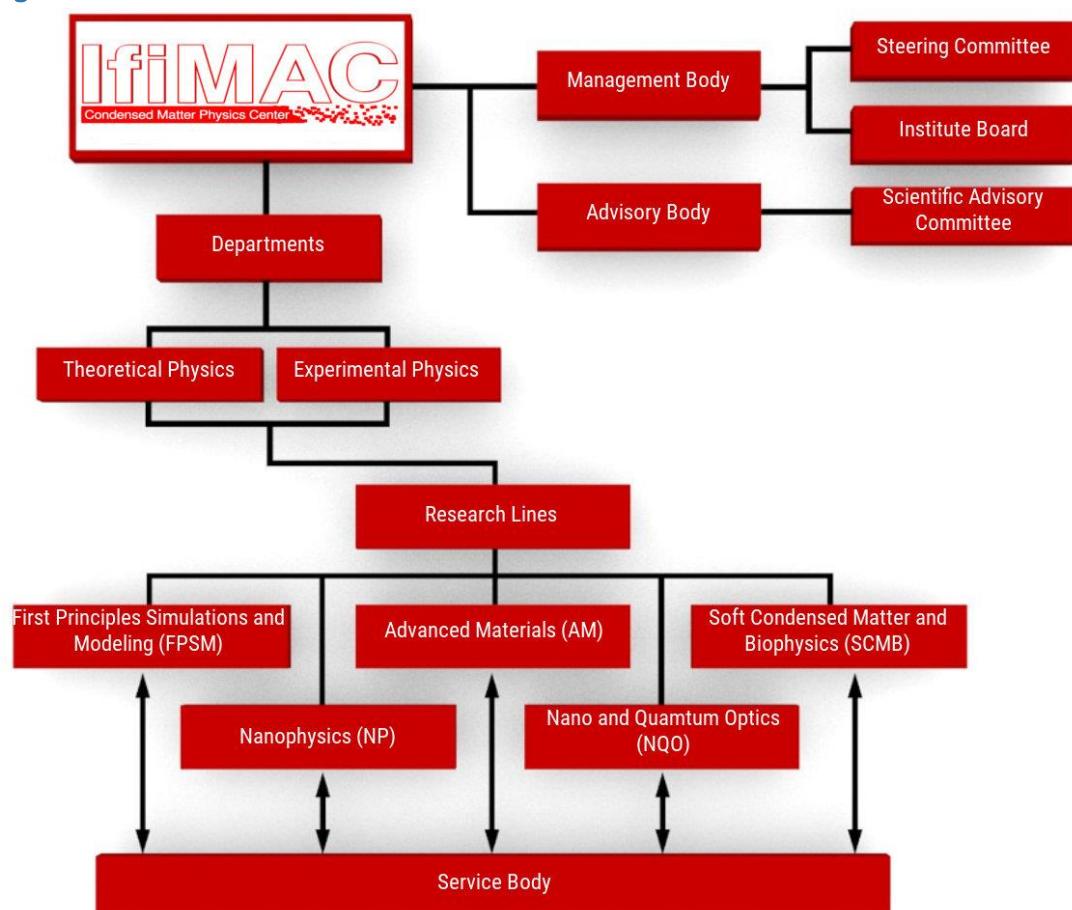
Prof. Juan Ignacio Cirac

Scientific Director at Max-Planck Institut für Quantenoptik (Germany).

Prof. Jan van Ruitenbeek

Professor at Leiden University (Holland).

Organization Chart



1.5 Gender Equality Committee

On April 2021 was created the Gender Equality Committee at IFIMAC. The main task of this Committee is to generate good practices and promote specific activities targeted at strengthening the role of women in Science, also particularly inside IFIMAC, as well as raising awareness of the IFIMAC members on gender equality issues in science. Currently the gender committee is composed by six researchers: I. Guillamón, J. Feist, M. Jaafar, C. Polop, F. Marchetti and C. Gomez-Navarro

The activities designed to reach these broad goals are organised in different areas: diagnosis and monitoring, participation, visibility and awareness, and support for students. Each of these areas and their specific actions are promoted and carried on by different female and male members of IFIMAC. During 2022 the activity of this committee has been focus on:

Performing an initial diagnostic report regarding gender equality at IFIMAC. This report will analyze the IFIMAC indicators and statistics improving the gender disaggregated data collection. We are evaluating indicators such as the number of hired personnel and Principal Investigators on competitive projects fellowship or grant awardees.

Establishing the first edition of a mentoring program for female students. one of the first initiatives of this committee has been setting-up a mentoring program for undergraduate female physics students. This program seeks at-offering a close and friendly contact with research activities. In addition, it aims at:

- promoting the scientific career of women students of the graduate and master's degree
- providing female role models.
- empowering mentors.
- building a strong network between women in the academic field of physics

The first edition of this program started, after an intense communication campaign, with great success in September 2022 with a duration of one academic course. This year we account with the participation of 34 female mentees and 34 mentors (with no gender restriction)These numbers imply that 30% of the female physics students at UAM are enrolled in this mentoring program and more than 40% of senior researchers of IFIMAC participate as mentors.

Both mentees and mentors received an introductory course to mentoring before the launching of the program: mentors received a 6 hours course while mentees received a 2 hours session, both imparted by the external expert Louise Schubert, from Schubert consulting. The mentoring program was launched with an initial meeting starting by a gender equality talk and finished by a gathering coffee. The mentoring program is Currently running and it includes monthly or twice-monthly meetings between mentor and mentee of 1 hour and the possibility of visiting the mentor's research group.

This mentoring program was selected as a representative of success between young students to be presented in the latest SOMMa gender group meeting dedicated to mentoring activities.

Promoting outreach activities on the International Day of Women and Girls in Science (11 February) The activities are aimed at primary and secondary school students, with the aim of making visible the scientific activity of the women who work at IFIMAC and notice pioneering women in the history of science.

In 2022, the Condensed Matter Physics Center joined the celebration of the **International Day of Women and Girls in Science** through a series of talks in different schools and secondary schools, given by IFIMAC members.



Celia Gonzalez participated in the initiative [#100tifiques – https://100tifiques.cat/](https://100tifiques.cat/), organized by a consortium of research institutes. She gave an invited talk at Col·legi Sagrada Família Sant Andreu de Barcelona on February 11th. **Celia Gonzalez** also gave two online talks “**Acercando la ciencia al instituto**” at IES Cruz Santa de Tenerife, on February 9th, and “**La ciencia también es cosa nuestra**” at IES Eulogio Florentino Sanz, Arevalo (Avila) on February 16th.

Marta Fernández-Lomana

Marta Fernández-Lomana gave an invited talk “**Física de bajas temperaturas (Superconductores)**” at Colegio Mirasol (Fuencarral) for the student of 2nd grade of bachillerato category in sciences on February 23rd.



Cristina Gómez-Navarro gave a talk “**Mama quiero ser científica... ¿y ahora qué?**” at the BBVA “Move for equality” working group on February 10th.



Miriam Jaafar Ruiz-Catellanos

Miriam Jaafar Ruiz-Catellanos gave two talks “**Conociendo a una científica del nanomundo**” for the students from 1st and 2nd grade of Bachillerato category at Colegio Esclavas del Sagrado Corazón de Jesús (Madrid), on March, 3rd.



Linda Zotti gave a talk “**Electrónica molecular: ¿qué es eso? Y qué hace una mujer trabajando en eso?**” at Colegio Altair Internacional (Madrid) on March 14th.



Promoting participation: The Gender Equality Committee aim to achieve within two years a minimum of 40% of female members in the following committees: Steering Committee, Scientific

Advisory Board, Project evaluation committee, Grant commission, Recruitment commission, Thesis Defense Committees, Invited seminar

2. IFIMAC at a glance (2022)

198 articles

SCOPUS:

159/198 articles Q1

112/198 articles D1

WOS:

116/198 articles Q1

49/198 articles D1

118 projects

19 International projects

75 national projects

24 regional project

83 researchers

20 full Professor

21 Professor

19 Associate Profesor

1 Assistant Professor

18 Young researcher (RyC, Talent Grant, Junior Leader)

4 emeritus Professor

118 PhD students

34 Post doc students

12 Doctoral theses Defended

INDICATORS

- Publications

SCOPUS

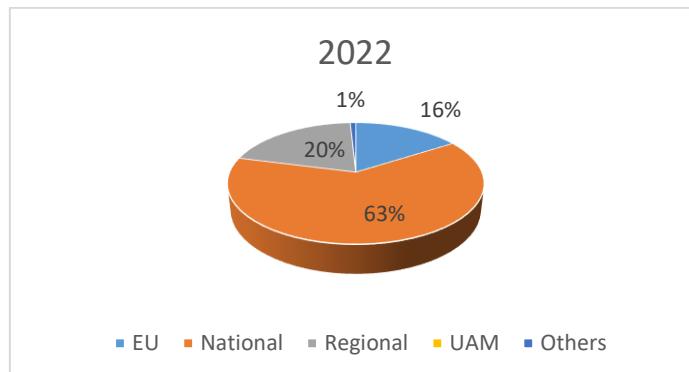
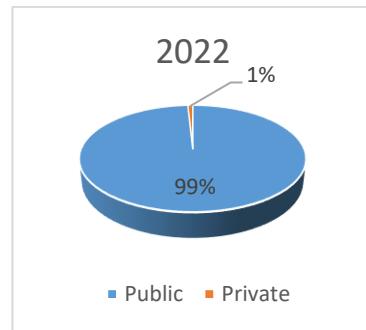
Articles	Q1 SCOPUS	%Q1	D1 SCOPUS	%D1
198	159	80,30%	112	56,57%

WOS

Articles	Q1 WOS	%Q1	D1 WOS	%D1
198	116	58,59%	49	24,75%

- Projects

Projects		Type		Financial Agency				
Year	Active projects	Public	Private	EU	National	Regional	UAM	Others
2022	119	118	1	19	75	24	0	1



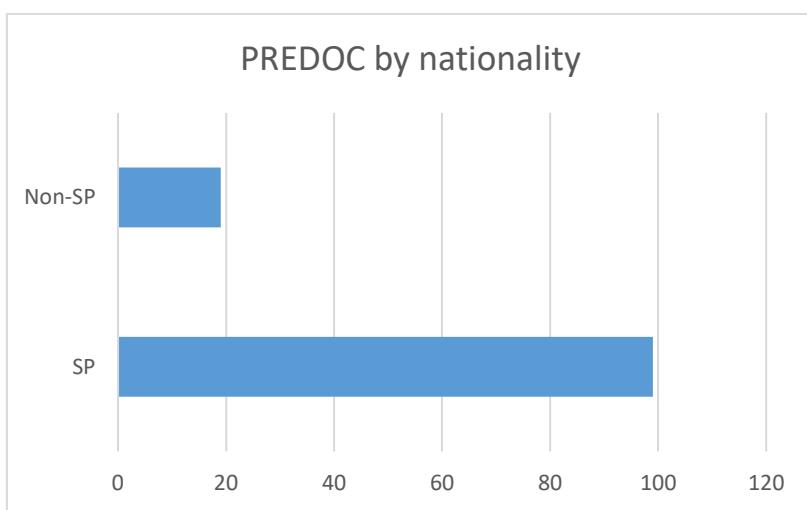
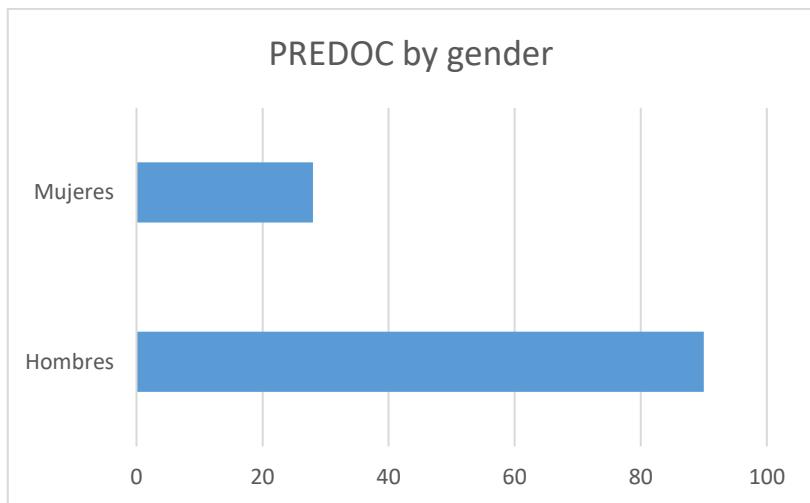
- Funding:

Total funding	International	National	Regional	Private
8.898.493,26	1.820.026,39	5.970.157,48	1.080.269,39	28.040,00
100%	20,45%	67,09%	12,14%	0,32%

- Human resources

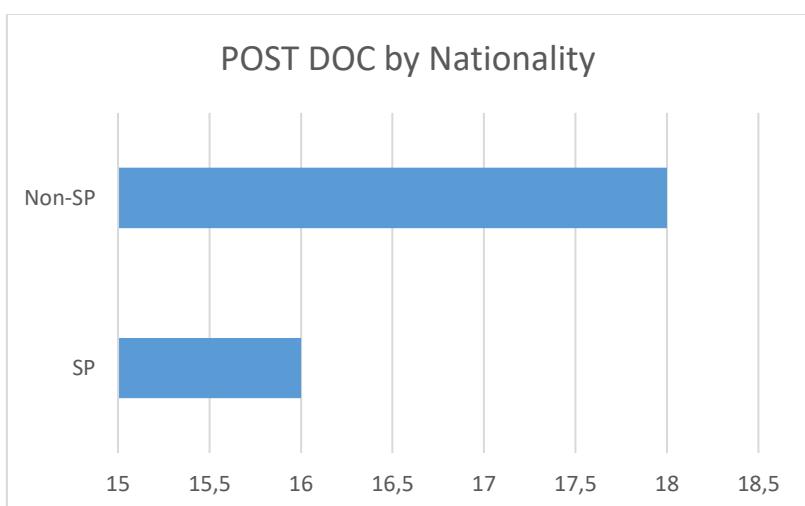
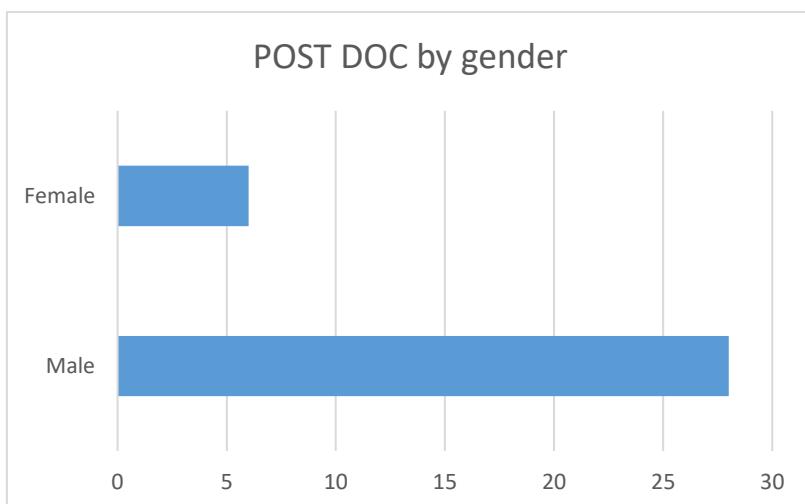
Predoc

	Gender		Nationality		TOTAL
	Male	Female	SP	Non-SP	
2022	90	28	99	19	118



Postdoc

	Gender		Nationality		TOTAL
	Male	Female	SP	Non-SP	
2022	28	6	16	18	34



- **Doctoral thesis defended**

Year	Thesis defended
2022	12

3. RESEARCH

3.1 MAIN RESEARCH ACTIVITIES

IFIMAC COLABORATIVE PROJECTS

As a part of our strategic program (2019-2023) within the Maria de Maeztu Excellence Accreditation, IFIMAC launched the third call for collaborative projects within different groups (between 3 and 5) working at IFIMAC. The projects funded with a budget of 160.000 euros each that are being carried out at IFIMAC are the following. A short summary of the progress of these projects during 2022 is given below:

- **Disorder as a novel platform for topological superconductivity**

Isabel Guillamón / Hermann Suderow, Miguel Ángel Ramos, Roberto Otero, Juan José Palacios

One of the aims of the project is to seek to prepare samples of bismuth (Bi) and alloys in which Bi transforms to a topological insulator (bismuth-antimony, Bi-Sb). The idea is to produce sufficient disorder so that these systems become superconducting (Bi becomes superconducting below 6 K in the amorphous state). The challenge is to overcome the strong tendency of Bi to crystallize even in single crystals of very small size, producing polycrystalline instead of amorphous behavior. We need to create inside the samples sufficiently large amorphous areas. To this end, we have irradiated Bi and Bi-Sb samples using protons, obtaining small-gap semiconductors. Amorphous Bi was prepared using a spinning technique. By evaporation, films of $BixSb100-x$ alloys ($x=0, 5, 10, 15$) have been prepared using different experimental conditions, and subsequently irradiated either with protons or Bi ions (up to 35 MeV). The resulting materials have been morphologically and structurally characterized by means of SEM and XRD. The electrical behavior in the temperature range of 2-300 K has until now semiconducting character. On the theory side, approaches to calculate the electronic properties of amorphous Bi are under development. Theory results have been published (Physical Review B 105, 155128, 2022), reporting the use of convolutional neural networks to predict the topological character of simple models of disordered systems. The technique seems promising, and the theory side is extending it to more realistic models using a Slater-Koster parametrization of amorphous Sb and Bi in two-dimensional form (for the time being, an extension to three dimensions might come later). This part of the project has been carried out by M. A. Ramos, H. Suderow, I. Guillamón and J.J. Palacios.

On the other hand, we have studied the natural defects in Bi(111) surfaces using tunneling microscopy/spectroscopy and tunneling electroluminescence. In particular, the spatial dependence of the electronic structure has been characterized around the different types of atomic defects found on the surface as well as the atomic steps, finding that the quasiparticle interference maps are very different depending on the nature of the defect. Likewise, plasmonic luminescence spectra have been obtained, which is surprising given the low density of electronic states at the Fermi level. Single crystals of the superconductor Bi2212 were also measured and characterized. This part of the project has been carried out in collaboration between R. Otero, H. Suderow and J.J. Palacios.

Finally, through a collaboration between I. Guillamón, H. Suderow and J.J. Palacios, it was shown that conduction through atomic size junctions presents a sizeable magnetic field dependence on fields as high as 20 T. Calculations on the conditions to observe magnetic field dependent conduction were carried out. Furthermore, the sixfold fermion system PdSb2 was analyzed from tunneling spectroscopy and theory, highlighting the role of surface states in the tunneling conductance.

- **Dynamically driving spinning colloidal particles in 2D lattices**

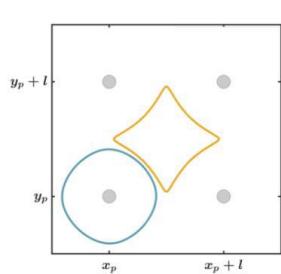
Juan. L. Aragonés, Laura. R. Arriaga, Salvatore Assenza , José. V. Alvarez

The main goal of the project is to fully characterize, in terms of transport and topological invariants, a novel topological active material comprising two key constituents: a suspension of colloidal particles that rotate under the external actuation of a homogenous magnetic field (so-called spinners) and an array of obstacles, which exhibits analogies with quantum topological materials (i.e. quantum Hall fluids) despite of its classical nature. We have started by characterizing the transport properties of this system as a function noise. This will enable us to test the robustness of this transport to perturbations, and ultimately tune and optimize the transport properties of this system.

Transport properties of spinners in disordered lattices of obstacles

We are considering the effect that the disorder and defects on the positions of the obstacles has on the transport properties of the spinners. The robustness of the transport properties of the system to the noise is one of the signatures of the topological-protected transport. We are considering different types of noises. First, we have analyzed the effect of decorrelated noise on the lattice positions of the obstacles, and now, we are studying the effect of correlated noise on the lattice positions. The correlated noise configurations are being obtained from the equilibrium configurations of a liquid in which the particles interact through a certain interaction potential with short- and long-range interactions. We characterize these disordered configurations of obstacles by identifying the relevant correlation length between the positions, which can be obtained from the radial distribution function. We have developed a novel method to obtain this characteristic length scale in model systems such as Lennard-Jones and Yukawa liquids, and we are testing its potential to identify the correlation length in real systems such as water. We are also analyzing the effect of defects (i.e. absence of obstacles in lattice positions) on the obstacle's network by studying the transport as function of the density of defects, considering its relationship with the percolation threshold of the lattice.

In the absence of noise on the obstacle's lattice positions, the active rotating particle, or spinner, is trapped in two types of trajectories independently of the attraction between spinner and the obstacle, but depending on the rotational angular frequency of the particle (ω) and independently of the attraction: i) obstacle-centered trajectories at small ω (blue trajectory in Fig.1), and ii) hollow-centered trajectories at higher ω



of noise on the obstacle's lattice positions, the active rotating particle, or spinner, is trapped in two types of trajectories independently of the attraction between spinner and the obstacle, but depending on the rotational angular frequency of the particle (ω) and independently of the attraction: i) obstacle-centered trajectories at small ω (blue trajectory in Fig.1), and ii) hollow-centered trajectories at higher ω

(orange trajectory in Fig.1), as shown in Fig.1. Interestingly, the presence of noise on the lattice positions of the obstacles breaks the lattice symmetry, and the spinner escape these confined trajectories travelling through the lattice. Thus, contrary to intuition, active spinning matter exhibits disorder-enhanced transport, which is the opposite to passive systems [1]. We have computed the time-averaged mean square displacements (MSD) with and without attraction between the active particle and the obstacles, as shown in Fig. 2.

Figure 1. Steady state solutions of the system at two spinner's angular velocities, at lower ω (blue trajectory) and higher ω (orange trajectory).

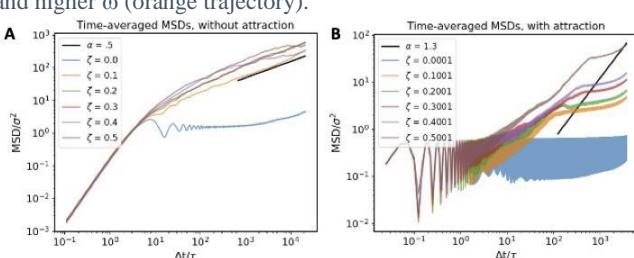


Figure 2. Time-averaged mean square displacements in log-log scale of the spinner in lattices of area fraction $\phi = 0.16$ at different noise levels on the obstacle's positions (ζ) without spinner-obstacle attraction (A) and with attraction (B). The black solid line has slope $\alpha = 0.5$ in A (subdiffusive transport) and $\alpha = 1.5$ in B (superdiffusive transport), where $MSD = 4Dt^\alpha$.

Interestingly, we observe that in the pure repulsive case, the longtime transport is not diffusive, but subdiffusive, as shown by the solid black line in Fig. 2A. This means that even small amounts of noise are enough to break the symmetry of the lattice and the spinner can escape the trapped trajectories. However, in the case of pure hydrodynamics the spinner exhibits a transient subdiffusive that arise from transient trapping within a heterogeneous environment [2]. In addition, we observe that the transport coefficient

of the spinner is independent of the noise level. Again, contrarily to intuition, in the presence of an attractive interaction between the spinner and the obstacles, the longtime transport of the spinner in this disordered media becomes superdiffusive. In this case, the spinner instead of hop between the voids of the lattice, jumps from obstacle to obstacle. Therefore, as the noise level on the obstacle's lattice positions increases, the open trajectories that the spinner can find increases.

In parallel to the numerical simulations, we are carrying out experiments. In this case, we create the arrays of obstacles by attaching polystyrene particle to a glass slide. Therefore, we are studying disordered lattices, but for now, we do not have control over the amount or type of disorder. However, we can choose regions where the obstacles are more symmetric or ordered. As expected, spinners in local ordered regions are trapped and localized, as it can be seen in Fig. 3. Moreover, for spinners in more disordered regions, we observe a similar behavior to the numerical case with attractive interactions between the spinner and the obstacles. Spinners in regions with a higher local disorder exhibit long trajectories across the lattice, jumping from obstacle to obstacle. Thus, the time-averaged MSD shows a superdiffusive transport ($\alpha = 1.5$).

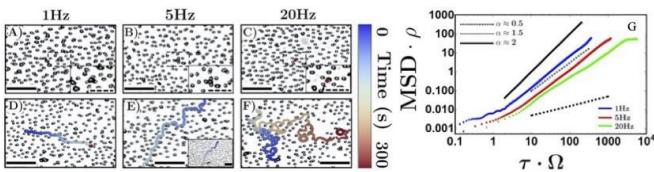


Figure 3. Experimental trajectories of spinners in ordered (A-C) and disordered environments (D-E) at three different rotational frequencies 1Hz (A-D), 5Hz (B-E), and 20Hz (C-F). Spinners in local ordered regions are trapped and localized. The solid scale bars are $50\mu\text{m}$ and the dashed scale bars are $16\mu\text{m}$. Whereas

spinners in local disordered regions become delocalized and translates across the lattice. G) Time-averaged mean square displacements in log-log scale of the spinner, where τ is the lag time, ρ the obstacle's density and Ω the spinner's rotational frequency.

We are moving forward on how to control the configurations of the obstacles. We have generated random configurations of obstacles in the computer, and we have ordered the mask to BlackHole Lab, which will be the mold to produce the lattices of obstacles in a controlled manner in PDMS.

Previously, our Center funded other five proposals in two different calls for this kind of projects involving several research groups to strengthen the internal collaborations to boost scientific excellence

First Call:

Virus as molecular containers: transport, delivery and nanoreactors (Pedro J de Pablo Gómez, José Ortega Mateo, Rafael Delgado Buscalioni)

Visualizing, understanding and controlling Andreev bound states down to atomic scale (Hermann Suderow Rodríguez, Alfredo Levy Yeyati , Álvaro Martín Rodero, Miguel Angel Ramos Ruiz , Jose Gabriel Rodrigo Rodriguez, Isabel Guillamón Gómez)

Second call:

Single-photon generation in 2D crystals for quantum information (Juan José Palacios Burgos , Elsa Prada , Gabino Rubio Bollinger , José Manuel Calleja Pardo, Snezana Lazic , Carlos Tejedor de Paz , Luis Viña Liste)

Ultrahigh pressure chemistry at the nanoscale (Julio Gómez Herrero, Enrique García Michel , José María Gómez Rodríguez , Daniel Farías Tejerina, Félix Zamora Abanades, Fernando Martín García)

Charge and heat transport in atomic, molecular and protein-based junctions (Nicolás Agrait de la Puente , Juan Carlos Cuevas y , Rubén Pérez Pérez)

YOUNG RESEARCHERS

One of the most important and decisive action within the Maria de Maeztu Grant has been the hiring of three brilliant international young researchers. Thanks to the financial support of this grant, IFIMAC was able to offer three new *four-years contracts* plus an additional money to develop their research group to these three researchers:

SAÜL VÉLEZ pursued his master's (2008) and PhD studies (2012) at the University of Barcelona under the supervision of Prof. Tejada, receiving in both the Extraordinary award for his results on quantum magnetism. In April 2013, Saül joined the nanodevices group at CIC nanoGUNE to work with Prof. Hueso with the purpose to transition towards spintronics and nanodevices, areas in which he is now a reference. From September 2017 to May 2021, Saül also hold a senior postdoctoral position in the groups of Prof. Gambardella and Prof. Fiebig at ETH Zürich. With interest in spintronics, magnetotransport, and optoelectronics phenomena, his recent research focused on exploring magnetoresistive effects and magnetic dynamic phenomena in metal/oxide heterostructure devices. Among his discoveries, he has demonstrated that interfacial interactions and spin currents can be used for probing and manipulating the magnetic moments of electrically insulating materials, opening a new research field with profound fundamental and technological impacts. His contributions to polaritonics and optoelectronics in low dimensional materials and heterostructures are also multiple. Saül joined IFIMAC in June 2021 as Junior Group Leader and found the Spintronics and Nanodevices group. In his lab, he aims at exploring non-conventional materials and new device concepts for spintronic applications.

Dr. Saul Velez was awarded with a RyC grant (that he rejected to incorporate to his talent grant) and a Talent Attraction grant from the Community of Madrid in year 2021. On January 2022 he started his talent grant contract at IFIMAC.

AKASHDEEP KAMRA obtained his master degree in Electrical Engineering from the Indian Institute of Technology Kanpur and a PhD in Physics from the Delft University of Technology, Netherlands. Then he worked as an Alexander von Humboldt postdoc fellow at the University of Konstanz, Germany before joining Norwegian University of Science and Technology as an independent researcher. His primary interest lies in the theory of spin-dependent phenomena in magnetic insulators, (super)conductors and their hybrids. Akash especially enjoys working on research problems that exploit knowledge from different sub-fields of Physics. While being a “theorist”, he has performed several experiments first hand in the past and continues to collaborate closely with experimentalists. When not enjoying Physics, Akash likes to go hiking and exploring new places.

Dr. Akashdeep Kamra was awarded with a Ramón y Cajal grant (2021 call), starting his contract as RyC researcher at the beginning of 2023.

PABLO ARES research interests have a marked multidisciplinary character within the framework of nanoscience and nanotechnology. They are focused on the use and development of scanning probe microscopies, mainly atomic force microscopy (AFM), for the study of low-dimensional systems, with particular attention to 2D materials. He received his B.S. and Master degree in Physics at the Universidad Complutense de Madrid (Spain) in 2003. He then joined the company Nanotec Electrónica S.L. (devoted to the design,

development and commercialization of scanning probe microscopes) as an Application Scientist. In 2014, he moved to the Universidad Autónoma de Madrid (Spain), where in 2017 he obtained his Ph.D. in Condensed Matter Physics and Nanotechnology under the supervision of Prof. Julio Gómez-Herrero and Dr. Adriana Gil. His thesis presented a double scientific-technical aspect, with advances on the AFM technique itself, as well as with more fundamental science studies, such as the isolation and study of antimonene, pioneering the worldwide experimental research on this novel 2D material.

After this, he joined the Graphene Group at the Condensed Matter Physics department of the University Of Manchester (UK) as a Research Associate working with Prof. Konstantin S. Novoselov and Dr. Laura Fumagalli. Once there he gained a Marie Skłodowska-Curie Individual Fellowship in 2018. His research during this time focused on basic properties of 2D materials and their combination in van der Waals heterostructures, and their use for the study of electrical properties of molecules under extreme confinement.

Dr. Pablo Ares was awarded with a Ramón y Cajal grant (2020 call), and he started his contract as RyC researcher in 2022

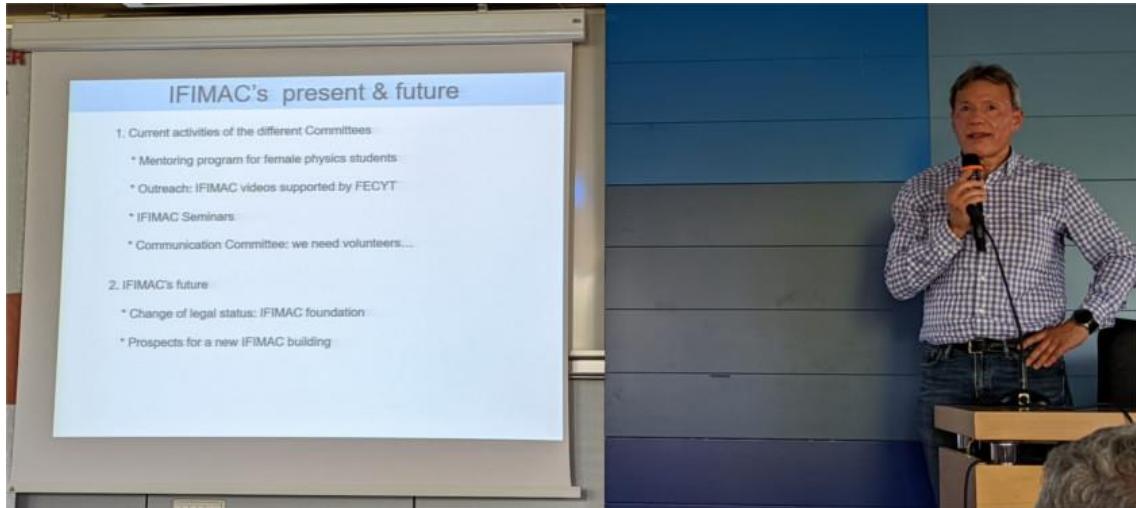
In a previous call in the frame of the first accreditation as a María de Maeztu unit of excellence, IFIMAC attracted other three top young researchers:

- 1) EDUARDO LEE: His research program is focused on the investigation of hybrid superconductor-semiconductor quantum dot devices. It is divided in two main directions: (i) the exploration of arrays of proximity- coupled QDs as a potential system for building a 1D topological superconductor with edge MZMs, and (ii) the development of hybrid devices towards applications in nanoelectronics. It is important to notice that Dr. Eduardo Lee was awarded with an ERC Starting Grant in year 2016.
- 2) FERRY PRINS: The aim of his research project is to establish an experimental research group focused on understanding and controlling light-matter interactions at the nanoscale. To achieve this, his group will study carefully chosen combinations of photonic, plasmonic, and excitonic effects that are characteristic of nanostructured materials and interfaces. Specifically, they will use innovative processing strategies to eliminate losses in exciton transport in quantum dot solids through photonic control, open up routes towards excitonic circuitry using the unique properties of 2D semiconductors, and develop plasmonic nanopores for nanoscale spectroscopy. Dr. Ferry Prins was awarded with a Talent Attraction grant from the Community of Madrid in year 2016, and with a Ramón y Cajal grant in 2019
- 3) JOHANNES FEIST: The theoretical research that he conducts within IFIMAC is related to the field of strong coupling of organic molecules with confined light modes. This field relies on the recent progress in nanophotonics and nanoplasmonics that has allowed unprecedented control over electromagnetic fields on the nanoscale, creating confined modes of light that can couple to excitations in a material. One of the major goals of this research is how confined light modes can be used to significantly alter material and chemical properties of organic materials. It is important to notice that Dr. Johannes Feist was awarded with an ERC Starting Grant in year 2016, and was awarded with a Ramón y Cajal Grant in 2018

IFIMAC Day 2022 “10 years of IFIMAC”

On June 2022 we celebrated our first IFIMAC DAY. The goal of the meeting was to gather all the people that are part of IFIMAC (members, together with postdoctoral

researchers and PhD students working in their research groups), to celebrate the activities developed in our centre since its creation in 2012.



The meeting included a short introduction by the IFIMAC Director, and a series of talks on all of the collaborative projects funded by IFIMAC so far--one of the landmarks in our research activity funded by the two Maria de Maeztu excellence accreditation--. These talks were given by a member of the project and included a summary of the main scientific results, along with a brief assessment of the lasting influence of the collaboration in the research activity of each group.

In between the talks, we had a poster session where PhD students and postdocs were able to share their work at IFIMAC



To facilitate interaction between all the attendants, we organized a buffet lunch at the Plaza Mayor, UAM Campus.

The talks given were the following:

“Disorder as a novel platform for topological superconductivity” (Juan José Palacios)



“Charge and heat transport in atomic and molecular junctions” (Nicolás Aguirre)



“Dynamically driven spinning colloidal particles in 2D lattices: a topological active metamaterial” (Juan Luis Aragón)



“Ultrahigh pressure chemistry at the nanoscale” (Pablo Ares)



“Single-photon generation in 2D crystals for quantum information” (Herko Van der Meulen),



“Virus as molecular containers: transport, delivery and nano-reactors. Challenges and results” (Pedro J. de Pablo)



“Visualizing, understanding and controlling Andreev bound states down to atomic scale” (Hermann Suderow)



SEMINARS

During the year 2022 we have continued with the joint IFIMAC ICMMM Seminars that started in 2020, as a consequence of the covid 19 pandemic, in order to adapt the IFIMAC Seminars to the needs of that time. The online format has meant a double opportunity for us. On the one hand, it has allowed us to count with renowned international (and also national) speakers on a weekly basis. On the other hand, it has enabled us to reach an international audience that is well beyond the area of the UAM campus and Madrid. In addition, during 2022, with the return to normality after covid 19, we have considered to relaunch the IFIMAC onsite seminars without giving up the advantages that the online/joint format have brought. In 2022, were held 25 joint IFIMAC ICMM Seminars along with 2 IFIMAC Seminars, that were the beginning of a new Series of IFIMAC Colloquium for 2023.

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- **IFIMAC+ICMM 2022 Seminars**



Caitlin Howell
University of Maine (USA)
“Engineering Bio-Inspired Surfaces to Control Biological Systems”
January 1st 2022; 12.00h
IFIMAC+ICMM Hybrid format. Sala de Seminarios, 5^a planta, Módulo 5, Facultad de Ciencias, UAM (Spain)

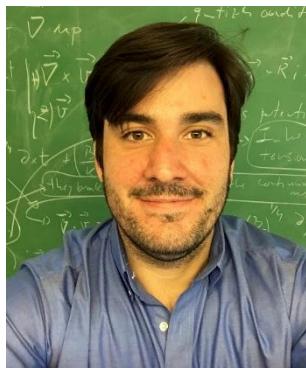
Héctor Ochoa

Donostia International Physics Center (Spain) and Columbia University in New York (USA)

“Phase” fluctuations of moiré superlattices

January 20th 2022; On line 12:00h

IFIMAC+ICMM Hybrid format. Salón de Actos at ICMM, C/ Sor Juana Inés de la Cruz 3, 28049 Madrid



Elena Hassinger

Max Planck Institute for Chemical Physics of Solids, Dresden (Germany)

“Field-induced transition from even to odd parity superconductivity in CeRh₂As₂”

<https://youtu.be/Ynm3BSEpho>

January 27th 2022; On line 12:00h

IFIMAC+ICMM



Wiebke Drenckhan

Max Planck Institute for Chemical Physics of Solids, Dresden (Germany)

*“Institut Charles Sadron, CNRS UPR22
University of Strasbourg, France”*

<https://youtu.be/TKjGJfHr25c>

February, 3rd 2022; On line 12:00h

IFIMAC+ICMM



Bruno de la Torre

Regional Centre of Advanced Technologies and Materials, Palacký University, Olomouc, CZ

“Imaging the anisotropic charge distribution within a single atom with Scanning Probe Microscopy”

<https://youtu.be/cUxS49-1Ovg>

February 10th 2022; On line 12:00h

IFIMAC+ICMM





Gloria Platero
Instituto de Ciencia de Materiales de Madrid,
ICMM-CSIC

“Simulation of topological phases in quantum dot arrays”

February, 17th 2022; On line 12:00h

IFIMAC+ICMM Hybrid format. Salón de Actos at
ICMM, C/ Sor Juana Inés de la Cruz 3, 28049
Madrid



Adolfo del Campo
University of Luxembourg
“Topological Defects in a Quantum Annealer”

February, 24th 2022; On line 12:00h

IFIMAC+ICMM



Natalia Ares
Department of Materials, Oxford University (UK)
“Quantum devices as a meeting point between thermodynamics and artificial intelligence”

March, 3rd 2022; On line 12:00h

IFIMAC+ICMM



Christian Schneider
Institute for Physics, Carl von Ossietzky University
Oldenburg
“Exciton-Polaritons and their condensates in microcavities loaded with atomically thin crystals”

<https://youtu.be/DTIiAzUvehU>

March, 10th, 2022; On line 12:00h

IFIMAC+ICMM



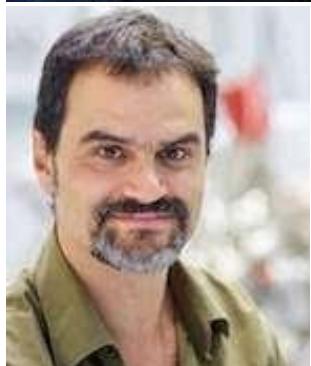
Larz Fritz
Institute of Theoretical Physics University of
Utrecht

*“Hydrodynamic electrons in Dirac type systems:
the role of particle-hole pairs”*

https://youtu.be/s_yuLq1OWpk

March 24th 2022; On line 12:00h

IFIMAC+ICMM



Nacho Pascual
CIC nanoGUNE, San Sebastian - Donostia, 20018,
Spain.

*“Emergence of π -Paramagnetism in Engineered
Graphene Nanostructures”*

March, 31st 2022

On line 12:00h

IFIMAC+ICMM



Esther Amstad Material Science Department
(IMX) Ecole Polytechnique Fédérale de Lausanne
(EPFL) (Switzerland).

*“Drops: a tool to produce recyclable load-bearing
hydrogels”*

<https://youtu.be/y30u9O0h5tE>

April, 7th 2022; On line 12:00h

IFIMAC+ICMM



Silvia Picozzi
Consiglio Nazionale delle Ricerche, Istituto CNR-
SPIN Chieti, c/o Univ. “G. D’Annunzio” Chieti-
Pescara, 66100 Chieti (Italy)

*“Spin-orbit coupling: an endless source of complex
magnetism”*

April, 21st 2022; On line 12:00h

IFIMAC+ICMM

Luca Chirolli
Istituto Nanoscienze



Consiglio Nazionale delle Ricerche, Istituto
CNR•NANO

*“Enhanced coherence and Majorana qubits in
superconducting circuits featuring nperiodic
Josephson junctions”*

<https://youtu.be/9u4nx5uWzOQ>

April, 28th 2022; On line 12:00h

IFIMAC+ICMM



Alexandra Palacio-Morales
Laboratoire de Physique des Solides Université
Paris-Saclay (France)

*“Misfit Layer Compounds: A Platform for Heavily
Doped 20 Transition Metal Dichalcogenides”*

May, 5th 2022; On line 12:00h

IFIMAC+ICMM



Tobias Stauber

Instituto de Ciencia de Materiales de Madrid, CSIC)

“Correlated phases in multilayer graphene”

<https://youtu.be/BJnjl-pK9B0>

May 12th 2022; On line 12:00h

IFIMAC+ICMM



Giorgio Benedek

Donostia International Physics Center (DIPC) Dept.
of Materials Science, Università di Milano-Bicocca

*“The surface electron-phonon interaction at
conducting surfaces measured with He atom
scattering”*

May 19th 2022; 12:00h

Sala de Conferencias, 6^a planta, Módulo 3, Facultad
de Ciencias (UAM); IFIMAC+ICMM



Anton Akhmerov Quantum Tinkerer group Delft
University of Technology The Netherlands
*“Josephson versus Andreev: what can we do with
only tunnel junction circuits?”*

<https://youtu.be/BLQUF3O7AqQ>

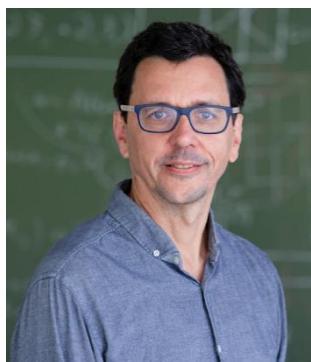
May 26th 2022; On line 12:00h
IFIMAC+ICMM



Christophe Galland
Institute of Physics, EPFL Switzerland
*“Molecular Optomechanics: a fresh look on Raman
scattering”*

<https://youtu.be/ln8Zgjx35H4>

June, 2nd 2022; 12:00h
Sala de Conferencias, 6^a planta, Módulo 3, Facultad
de Ciencias (UAM)
IFIMAC+ICMM



Sebastián Bergeret
Centro de Física de Materiales CFM, CSIC-UPV,
San Sebastián
*“Magnetolectric effects and non-reciprocal
transport in superconducting systems”*

June, 16th 2022; On line 12:00h
IFIMAC+ICMM



Luis Gonzalez MacDowell
Physical Chemistry Department, Universidad
Complutense de Madrid, Spain
“Fluctuating Interfaces”

October, 6th 2022; On line 12:00h
IFIMAC+ICMM



Hans Huebl

Walther-Meissner-Institut, Bayerische Akademie

der Wissenschaften, Garching, Germany

“*Sensing Solid-State Excitations with Hybrid
Quantum Systems*”

<https://youtu.be/VBTipdMKCj0>

October, 20th 2022; 12:00h

Hybrid On-line On-site; Sala de Seminarios, 5^a
planta, Módulo 5, Facultad de Ciencias (UAM);

IFIMAC+ICMM



Iván López-Montero

Department of Physical Chemistry, Universidad
Complutense de Madrid, Spain

“*in vitro reconstitution of cellular functions to study
the self-assembly and dynamics of biomembranes*”

November, 11st, 2022; 12:00h

Hybrid On-line On-site Sala de Seminarios, 5a.
planta, Módulo 5, Facultad de Ciencias (UAM)

IFIMAC+ICMM



Eduardo Lee

Vondensed Matter Physics Center, IFIMAC UAM

“*Joule spectroscopy of hybrid superconductor
semiconductor nanodevices*”

<https://www.youtube.com/watch?v=OTzKLvUm9Js>

November 17th 2022; On line 12:00h

IFIMAC+ICMM



Richard Schlitz

Department of Materials, ETH Zurich (Switzerland)

“*Investigating individual spins on surfaces by
electron paramagnetic resonance in a scanning
tunneling microscope*”

December, 1st 2022

On-site venue: Sala de Seminarios, 5th floor,
Módulo 3, Facultad de Ciencias (UAM)

- **IFIMAC 2022 SEMINARS**



Nurit Ashkenasy
Department of Materials Engineering and the Ilse Katz Institute for Nanoscale Science and Technology, Ben-Gurion University of the Negev, Beer-Sheva, Israel

“BIOINSPIRED ELECTRONIC MATERIALS”
September, 12th 2022

IFIMAC
Modulo 5, Seminar Room.
Online Zoom



Nicola Marzari
École Polytechnique Fédérale de Lausanne (EPFL) and Paul Scherrer Institut Switzerland “To see world in a grain of sand”
October, 26th 2022
Modulo 8, Sala de Grados. Facultad de Ciencias
16:00 h

PhD POSITION AT THE IFIMAC WITHIN THE PREDCTORAL FELLOWSHIPS PROGRAM OF THE SPANISH AEI AND THE FUNDACIÓN LA CAIXA INPHINIT PROGRAMME

We welcome 2 new PhD students, one in each Strategic research line:

- **GALOR GEVA** (Experimental condensed Matter Physics).

He is pursuing his PhD working in the project Dynamically driven spinning colloidal particles in 2D lattices: a topological active metamaterial, under the supervision of Laura R. Arriaga

- **MAKSIM LEDNEV** (Theoretical condensed matter physics). He is working and pursuing his PhD in the field of nano and quantum optics under the supervision of Johannes Feist and Francisco José García Vidal.

We also welcome a new PhD student, in the frame of Fundación La Caixa INPhINIT predoctoral programme:

- **ANNA LUISA ROMLING**. She is pursuing her PhD at IFIMAC on the young and emerging field of Quantum Magnonics under the supervision of Akashdeep Kamra.

3.2 RESEARCH PROJECTS

International R&D projects:

- 1. ANDREEV QUBITS FOR SCALABLE QUANTUM COMPUTATION- ANDQC**
Reference: GA 828948
Funding institution: COMISION EUROPEA
Period: 01/04/2019-31/03/2024
PI: LEVY-YEYATI MIZRAHI, ALFREDO
- 2. ATTOSECOND CHEMISTRY- ATTOCHEM**
Reference: CA18222
Funding institution: COMISION EUROPEA
Period: 25/10/2019-24/10/2023
PI: MARTIN GARCIA, FERNANDO
- 3. IMPROVING THE SUSTAINABILITY OF THE EUROPEAN MAGNETIC FIELD LABORATORY**
Reference: GA 871106
Funding institution: COMISION EUROPEA
Period: 01/11/2020-31/10/2024
PI: SUDEROW RODRIGUEZ, HERMANN JESUS
- 4. MAGNETOELECTRIC 3D PRINTING TECHNOLOGY - THE REVOLUTION OF ACTUATABLE COMPOSITES**
Reference: GA 101047081
Funding institution: COMISION EUROPEA
Period: 01/10/2022-30/09/2026
PI: ZAMORA ABANADES, FELIX JUAN
- 5. MID-INFRARED QUANTUM TECHNOLOGY FOR SENSING**
Reference: GA 101070700
Funding institution: COMISION EUROPEA Period: 01/10/2022-30/09/2025
PI: FERNANDEZ DOMINGUEZ, ANTONIO ISAAC
- 6. MODIFICATION OF MOLECULAR STRUCTURE UNDER STRONG COUPLING TO CONFINED LIGHT MODES - MMUSCLES**
Reference: GA 714870
Funding institution: COMISION EUROPEA
Period: 01/04/2017-31/03/2023
PI: FEIST, JOHANNES MAXIMILIAN
- 7. MOLECULAR DYNAMICS IN THE GAS PASE**
Reference: CA18212
Funding institution: COMISION EUROPEA
Period: 12/11/2019-11/11/2023
PI: DIAZ-TENDEROL VICTORIA, SERGIO
- 8. NANOSCALE COHERENT HYBRID DEVICES FOR SUPERCONDUCTING QUANTUM TECHNOLOGIES**
Reference: CA 16218
Funding institution: COST ASSOCIATION
Period: 18/10/2017-31/10/2022
PI: SUDEROW RODRIGUEZ, HERMANN JESUS

9. NOTsoQUANTUM: Realistic simulations of polaritonic chemistry

Reference: GA101029384

Funding institution: COMISION EUROPEA

Period: 01/09/2022-31/08/2025

PI: FEIST, JOHANNES MAXIMILIAN

10. QUANTUM INTERFERENCE ENHANCED THERMOELECTRICITY -QUIET

Reference: GA 767187

Funding institution: COMISION EUROPEA

Period: 01/02/2018-31/10/2022

PI: AGRAIT DE LA PUENTE, MARIO NICOLAS

11. SCANNING PROBE MICROSCOPY IN HIGH VECTORIAL MAGNETIC FIELDS: NEW DEVICE FOR IMAGING QUANTUM MATERIALS - VECTORFIELDIMAGING

Reference: 101069239

Funding institution: COMISION EUROPEA

Period: 01/06/2022-30/11/2023

PI: GUILLAMON GOMEZ, ISABEL

12. SUPERCONDUCTING NANODEVICES AND QUANTUM MATERIALS FOR COHERENT MANIPULATION - SUPERQUMAP

Reference: CA 21114

Funding institution: COMISION EUROPEA

Period: 06/10/2022-05/10/2026

PI: SUDEROW RODRIGUEZ, HERMANN JESUS

13. THE ULTIMATE TIME SCALE IN ORGANIC MOLECULAR OPTO-ELECTRONICS, THE ATTOSECOND

REFERENCE: GA 951224

Funding institution: COMISION EUROPEA

Period: 01/04/2021-31/03/2027

PI: MARTIN GARCIA, FERNANDO

14. THEORETICAL INVESTIGATION OF SURFACE PHONON POLARITON-BASED QUANTUM PHOTONIC CIRCUITS REFERENCE: GA 101067180

Funding institution: COMISION EUROPEA

Period: 01/10/2022-30/09/2024

PI: FERNANDEZ DOMINGUEZ, ANTONIO ISAAC

15. USING EXTREME MAGNETIC FIELD MICROSCOPY TO VISUALIZE CORRELATED ELECTRON MATERIALS - PNICTEYES

Reference: GA 679080

Funding institution: COMISION EUROPEA

Period: 01/03/2016-28/02/2022

PI: GUILLAMON GOMEZ, ISABEL

16. MISTI GLOBAL SEED FUND PROGRAM

Reference: 2021/00076/001

Funding institution: Massachusetts Institute of Technology

Period: 01/09/2021-31/12/2022

PI: PRINS, FERRY

17. MULTI-FUNCTIONAL ICEPHOBIC, ROBUST, LIGHTWEIGHT AND TRANSPARENT COATINGS FOR WINDOWS AND LENSES (IGC AS)

Reference: 300023

Funding institution: Ice Guard Coating AS

Period: 01/09/2019-28/02/2022

PI: FARÍAS TEJERINA, DANIEL

18. MULTI-FUNCTIONAL ICEPHOBIC, ROBUST, LIGHTWEIGHT AND TRANSPARENT COATINGS FOR WINDOWS AND LENSES (NORCE)

Reference: 300023

Funding institution: NORCE Norwegian Research Centre AS

Period: 01/09/2019-28/02/2022

PI: FARÍAS TEJERINA, DANIEL

19. PROTEIN NANOCAGES AS SINGLE MOLECULAR REACTORS TO UNDERSTAND BIOCATALYSIS IN CROWDED ENVIRONMENTS

Reference: RGP0012/2018

Funding institution: THE INTERNATIONAL HUMAN FRONTIER SCIENCE PROGRAM ORGANIZATION

Period: 01/06/2018-31/08/2023

PI: DE PABLO GOMEZ, PEDRO JOSE

National R&D Projects:

1. ACELERANDO LA TRANSICIÓN DIGITAL CON NANOFOTÓNICA CUÁNTICA: PLATAFORMAS

Reference: TED2021-130552B-C21

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/12/2022- 30/11/2024

PI: MARTÍN CANO, DIEGO

2. ACTIVATION OF GREENHOUSE GASES FOR CLEAN ENERGY FUELS: A COMBINED MOLECULAR BEAMS AND XPS STUDY

Reference: TED2021-130446B-I00

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/12/2022- 30/11/2024

PI: FARÍAS TEJERINA, DANIEL

3. CARACTERIZACIÓN DE EXCITACIONES ÓPTICAS EN MATERIALES 2D CON RESOLUCIÓN ATÓMICA

Reference: PID2021-128011NB-I00

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/09/2022- 31/08/2025 PI: OTERO MARTÍN, ROBERTO

4. CENTRO DE INVESTIGACION DE FISICA DE LA MATERIA CONDENSADA (IFIMAC)

Reference: CEX2018-000805-M

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 16/12/2019- 15/12/2023

PI: GARCIA VIDAL, FCO. JOSE

**5. CONFIGURACIÓN DE LA ESTRUCTURA ELECTRÓNICA DE MATERIALES 2D:
FOTORRESPUESTA Y PROPIEDADES DE ESPÍN**

Reference: PID2021-123295NB-I00

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/09/2022- 31/08/2025

PI: GARCIA MICHEL, ENRIQUE

**6. CONTROL A LA NANOESCALA DE NUEVAS PROPIEDADES INCORPORADAS AL
GRAFENO: SUPERCONDUCTIVIDAD, MAGNETISMO Y GAP ELECTRÓNICO**

Reference: PID2020-115171GB-I00

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/09/2021-45535

PI: BRIHUEGA ALVAREZ, IVAN

**7. CONTROL QUÍMICO DE REDES METAL-ORGÁNICAS DE ZIRCONIO PARA LA CAPTURA Y
DETECCIÓN ÓPTICA DE CONTAMINANTES AMBIENTALES**

Reference: PID2021-123839OB-I00

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/09/2022- 31/08/2025

PI: PLATERO PRATS, ANA EVA

8. ESTRUCTURAS SOSTENIBLES AVANZADAS PARA ENERGÍA Y FOTÓNICA-UAM

Reference: TED2021-129666B-C21

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/12/2022- 30/11/2024

PI: LAZIC, SNEZANA

**9. CORRELACIONES CUÁNTICAS E INTERFERENCIA DE FOTONES INTERACTUANTES EN
ESTRUCTURAS MATERIA-LUZ BIDIMENSIONALES**

Reference: PID2020-113415RB-C22

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/09/2021- 31/08/2024

PI: MARCHETTI, FRANCESCA MARIA

10. CUANDO LAS INTERACCIONES ADHESIVAS CONTROLAN EL MOVIMIENTO CELULAR

Reference: RTI2018-101953-A-I00

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/01/2019- 30/09/2022

PI: RODRIGUEZ ARRIAGA, LAURA

**11. DEFECTOS Y HETEROUNIONES BIDIMENSIONALES DE DICALCOGENUROS CON
METALES DE TRANSICIÓN**

Reference: PGC2018-093291-B-I00

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/01/2019- 30/09/2022

PI: LOPEZ VAZQUEZ DE PARGA, AMADEO

12. DESCIFRANDO LAS PROPIEDADES MAGNÉTICAS DE SISTEMAS BASADOS EN NANOHILOS Y NANOPARTÍCULAS PARA IMANES PERMANENTES

Reference: TED2021-130957B-C55

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/12/2022- 30/11/2024

PI: JAAFAR RUIZ-CASTELLANOS, MIRIAM

13. DIFRACTOMETRO DE RAYOS X DE MONOCRISTAL CON FUENTE DUAL

Reference: EQC2021-007518-P

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/06/2021- 31/12/2023

PI: ZAMORA ABANADES, FELIX JUAN

14. DINÁMICA Y RUIDO EN NUEVOS MATERIALES Y DISPOSITIVOS PARA PROCESAMIENTO ULTRA RÁPIDO Y NO DISIPATIVO DE SEÑALES

Reference: RTI2018-095303-B-C55

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/01/2019- 30/09/2022

PI: ALIEV KAZANSKI, FARKHAD

15. DINÁMICA, TRANSPORTE DE ESPÍN Y RUIDO EN ANTIFERROMAGNÉTICOS EPITAXIALES Y OTROS SISTEMAS NOVEDOSOS PARA PROCESAMIENTO ULTRARRÁPIDO Y POCO DISIPATIVO DE SEÑALES

Reference: PID2021-124585NB-C32

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/09/2022- 31/08/2025

PI: ALIEV KAZANSKI, FARKHAD

16. DISEÑO DE MATERIALES 2D PARA APLICACIONES DE ENERGÍA: MEMBRANAS Y BATERÍAS

Reference: PID2019-106268GB-C32

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/01/2020- 30/09/2023

PI: ZAMORA ABANADES, FELIX JUAN

17. DISEÑO DE MATERIALES 2D PARA APLICACIONES EN ENERGÍA: NANOELCTROMECANICA

Reference: PID2019-106268GB-C31

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/01/2020- 30/09/2023

PI: GOMEZ-NAVARRO GONZALEZ, CRISTINA

18. EFECTOS DE MUCHOS CUERPOS Y TRANSPORTE EN SEMIMETALES TOPOLOGICOS

Reference: PID2021-127240NB-I00

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/09/2022- 31/08/2025

PI: CORTIJO FERNANDEZ, ALBERTO

19. ELECTRÓNICA COHERENTE EN DISPOSITIVOS SUPERCONDUCTORES

Reference: PID2020-117992GA-I00

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/09/2021- 31/08/2025

PI: BURSET ATIENZA, PABLO

20. ENHANCING THE MECHANICAL STABILITY OF INTERFACES IN SOLID-STATE LI-ION BATTERIES FOR ENERGY-INTENSIVE APPLICATIONS

Reference: PCI2022-132998

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/05/2022- 30/04/2025

PI: POLOP JORDA, CELIA

21. ESCALADO INDUSTRIAL DE TINTAS BASADAS EN MATERIALES BIDIMENSIONALES: CARACTERIZACIÓN Y RECUBRIMIENTOS

Reference: PDC2021-120782-C22

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/12/2021- 30/11/2023

PI: GOMEZ HERRERO, JULIO

22. ESCALADO INDUSTRIAL DE TINTAS BASADAS EN MATERIALES BIDIMENSIONALES: PREPARACIÓN Y RECUBRIMIENTOS

Reference: PDC2021-120782-C21

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/12/2021- 30/11/2023

PI: ZAMORA ABANADES, FELIX JUAN

23. ESTRUCTURAL LOCAL DE MATERIALES NANO-POROSOS EN ACCIÓN

Reference: EUR2020-112294

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/12/2020-45260

PI: PLATERO PRATS, ANA EVA

24. ESTUDIO DE LA INTERACCION BIOFISICA ENTRE NANOCONTENEDORES PROTEICOS Y SU CONTENIDO MOLECULAR: MECANICA ESTRUCTURAL, LIBERACION DE LA CARGA Y CATALISIS CONFINADA

Reference: FIS2017-89549-R

Funding institution: MINISTERIO DE ECONOMIA Y COMPETITIVIDAD

Period: 01/01/2018- 30/09/2022

PI: DE PABLO GOMEZ, PEDRO JOSE

25. ESTUDIOS COMPUTACIONALES DE MATERIALES BIOMOLECULARES Y BIOINSPIRADOS

Reference: PID2021-125604NB-I00

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/09/2022- 31/08/2025

PI: ORTEGA MATEO, JOSE

**26. EXPLORANDO LA INTERACCIÓN ENTRE PARTÍCULAS VÍRICAS Y MATERIALES:
FUNDAMENTOS Y APLICACIONES PROFILÁCTICAS (INFRAESTRUCTURA)**

Reference: VIRMAT

Funding institution: CONSEJERIA CIENCIA, UNIVERSIDADES E INNOVACION

Period: 01/02/2020- 31/12/2022

PI: DE PABLO GOMEZ, PEDRO JOSE

**27. EXPLORANDO LA INTERACCIÓN ENTRE PARTÍCULAS VÍRICAS Y MATERIALES:
FUNDAMENTOS Y APLICACIONES PROFILÁCTICAS (PROYECTO)**

Reference: VIRMAT

Funding institution: CONSEJERIA CIENCIA, UNIVERSIDADES E INNOVACION

Period: 01/02/2020- 31/12/2022

PI: DE PABLO GOMEZ, PEDRO JOSE

**28. EXPLORANDO LOS DETERMINANTES FÍSICOS Y ESTRUCTURALES DE LA
DEACTIVACIÓN DE VIRUS INDIVIDUALES SOBRE SUPERFICIES: ATRAPAMIENTO,
BIOMECÁNICA Y DESEMPAQUETAMIENTO GENÓMICO**

Reference: PID2021-126608OB-I00

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/09/2022- 31/08/2025

PI: DE PABLO GOMEZ, PEDRO JOSE

**29. EXTENDIENDO LOS LÍMITES DE LA FÍSICA DE ATTSEGUNDOS: VISUALIZACIÓN Y
CONTROL DE PROCESOS DE TRANSFERENCIA ELECTRÓNICA EN SISTEMAS DE INTERÉS
QUÍMICO Y BIOLÓGICO**

Reference: PID2019-105458RB-I00

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/06/2020- 31/05/2023

PI: MARTIN GARCIA, FERNANDO

**30. FABRICACIÓN ADITIVA EN METAL PARA LA INSTRUMENTACIÓN CIENTÍFICA
AVANZADA**

Reference: EQC2021-007318-P

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/06/2021- 31/12/2023

PI: GOMEZ HERRERO, JULIO

31. FLUJO DE CARGA Y ENERGÍA EN PROCESOS QUÍMICOS COMPLEJOS

Reference: PID2019-110091GB-I00

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/06/2020- 31/05/2023

PI: DIAZ-TENDERZO VICTORIA, SERGIO

**32. FUNDAMENTOS MICROSCÓPICOS DEL MICROSCOPIO DE FUERZAS ATÓMICAS Y
MICROBALANZAS DE CUARZO PARA SENSAR BIOMOLÉCULAS**

Reference: PID2020-117080RB-C51

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/09/2021- 31/08/2024
PI: DELGADO BUSCALIONI, RAFAEL

33. GRAFENO Y MATERIALES BIDIMENSIONALES PARA APLICACIONES EN ENERGÍA LIMPIA

Reference: PID2019-109525RB-I00
Funding institution: AGENCIA ESTATAL DE INVESTIGACION
Period: 01/06/2020- 31/05/2023
PI: FARIAS TEJERINA, DANIEL

34. HACÍA UN NUEVO QUBIT DE SHIBA BASADO EN PUNTOS CUÁNTICOS HÍBRIDOS SUPERCONDUCTOR-SEMICONDUCTOR

Reference: TED2021-130292B-C41
Funding institution: AGENCIA ESTATAL DE INVESTIGACION
Period: 01/12/2022- 30/11/2024
PI: LEVY-YEYATI MIZRAHI, ALFREDO

35. IDENTIFICACIÓN QUÍMICA Y CONTROL DE LAS PROPIEDADES ELECTRÓNICAS Y MECÁNICAS DE SISTEMAS MOLECULARES MEDIANTE MICROSCOPIAS DE PROXIMIDAD Y APRENDIZAJE AUTOMÁTICO

Reference: PID2020-115864RB-I00
Funding institution: AGENCIA ESTATAL DE INVESTIGACION
Period: 01/09/2021- 31/08/2024
PI: POU BELL, PABLO

36. INFLUENCIA DE LA NANOSTRUCTURACIÓN EN LAS PROPIEDADES MECANOQUÍMICAS DE CÁTODOS COMPOSITE ZERO-STRAIN PARA BATERÍAS DE ION LI DE ESTADO SÓLIDO

Reference: PID2021-124667OB-I00
Funding institution: AGENCIA ESTATAL DE INVESTIGACION
Period: 01/09/2022- 31/08/2025
PI: POLOP JORDA, CELIA

37. INGENIERÍA CUÁNTICA DE LUZ Y MATERIA EN LA NANOESCALA

Reference: PID2021-126964OB-I00
Funding institution: AGENCIA ESTATAL DE INVESTIGACION
Period: 01/09/2022- 31/08/2025
PI: FERNANDEZ DOMINGUEZ, ANTONIO ISAAC

38. LA FÍSICA DE LA MATERIA CONDENSADA SALE AL ENCUENTRO

Reference: FCT-21-17475
Funding institution: FECYT FUNDACIÓN ESPAÑOLA PARA LA CIENCIA Y LA TECNOLOGÍA
Period: 01/07/2022- 30/06/2023
PI: GOMEZ-NAVARRO GONZALEZ, CRISTINA

39. MANIPULAR LA MATERIA MEDIANTE LAS FLUCTUACIONES DEL VACÍO

Reference: PID2021-125894NB-I00

Funding institution: AGENCIA ESTATAL DE INVESTIGACION
Period: 01/09/2022- 31/08/2025
PI: GARCIA VIDAL, FCO. JOSE

40. MATERIALES CON ORDENAMIENTO FERROELÉCTRICO Y ANTIFERROMAGNÉTICO PARA APLICACIONES ESPINTRÓNICAS ULTRARRÁPIDAS Y CONTROLABLES ELÉCTRICAMENTE

Reference: PID2021-122980OA-C53

Funding institution: AGENCIA ESTATAL DE INVESTIGACION
Period: 01/09/2022- 31/08/2025
PI: VELEZ CENTORAL, SAUL

41. MATERIALES PARA LA INFORMACIÓN CUÁNTICA BASADOS EN EXCITONES EN SEMICONDUCTORES

Reference: PID2020-113445GB-I00

Funding institution: AGENCIA ESTATAL DE INVESTIGACION
Period: 01/09/2021- 31/08/2024
PI: VAN DER MEULEN, HERKO PIET

42. MATERIALES POROSOS AVANZADOS EN SEPARACIONES ENERGÉTICAS DE BAJA ENERGÍA DE GASES DE INTERÉS MEDIOAMBIENTAL

Reference: TED2021-129886B-C42

Funding institution: AGENCIA ESTATAL DE INVESTIGACION
Period: 01/12/2022- 30/11/2024
PI: ZAMORA ABANADES, FELIX JUAN

43. MATERIALES TOPOLOGICOS PARA FOTOVOLTAICA

Reference: TED2021-131323B-I00

Funding institution: AGENCIA ESTATAL DE INVESTIGACION
Period: 01/12/2022- 30/11/2024
PI: PALACIOS BURGOS, JUAN JOSE

44. MATERIALES Y SENSORES CUÁNTICOS MEDIANTE IMPLANTACIÓN DE IONES A MEV

Reference: PID2021-127498NB-I00

Funding institution: AGENCIA ESTATAL DE INVESTIGACION
Period: 01/09/2022- 31/08/2025
PI: RAMOS RUIZ, MIGUEL ANGEL

45. MECÁNICA DEL CALOR: UNIENDO TRANSPORTE DE CALOR Y FRICCIÓN EN LA NANOESCALA

Reference: TED2021-132219A-I00

Funding institution: AGENCIA ESTATAL DE INVESTIGACION
Period: 01/12/2022- 30/11/2024
PI: ARES GARCIA, PABLO

46. MICROSCOPÍAS DE BARRIDO A BAJAS TEMPERATURAS EN CAMPOS MAGNÉTICOS VECTORIALES

Reference: PDC2021-121086-I00

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/12/2021- 30/11/2023

PI: SUDEROW RODRIGUEZ, HERMANN JESUS

47. MICROSCOPIO ELECTRÓNICO DE BARRIDO DE EMISIÓN DE CAMPO DE ULTRA ALTA RESOLUCIÓN PARA APLICACIONES EN NANOLITOGRAFÍA, IMAGEN, ANÁLISIS QUÍMICO Y NANO-INGENIERÍA

Reference: EQC2021-007091-P

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/06/2021- 31/12/2023

PI: AGRAIT DE LA PUENTE, MARIO NICOLAS

48. MODELIZACION DE MATERIALES COMPLEJOS: BIOMOLECULAS Y SISTEMAS BIDIMENSIONALES

Reference: MAT2017-88258-R

Funding institution: MINISTERIO DE ECONOMIA Y COMPETITIVIDAD

Period: 01/01/2018 - 30/06/2022

PI: ORTEGA MATEO, JOSE

49. MULTI-FUNCTIONAL ICEPHOBIC, ROBUST, LIGHTWEIGHT AND TRANSPARENT COATINGS FOR WINDOWS AND LENSES

Reference: PCI2019-103586

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/09/2019- 28/02/2022

PI: FARIAS TEJERINA, DANIEL

50. NANODISPOSITIVOS FOTÓNICOS DE ESTADO SOLIDO OBTENIDOS POR COMBINACIÓN DE EMISORES DE TIERRAS RARAS, NANOESTRUCTURAS PLASMÓNICAS Y MATERIALES 2D

Reference: PID2019-108257GB-I00

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/06/2020- 31/05/2023

PI: BAUSA LOPEZ, LUISA EUGENIA

51. NANOINGENIERÍA DE DISPOSITIVOS DE ESTADO SÓLIDO PARA COMPUTACIÓN NEUROMÓRFICA

Reference: PID2020-116181RB-C31

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 44440- 31/08/2024

PI: CAMARERO DE DIEGO, JULIO

52. NUEVOS FENÓMENOS Y APLICACIONES DE MATERIALES TOPOLOGICOS FUERTEMENTE CORRELACIONADOS EN EQUILIBRIO Y FUERA DE EQUILIBRIO

Reference: RTI2018-098452-B-I00

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/01/2019- 31/12/2022

PI: MERINO TRONCOSO, JAIME

53. NUEVOS SUPERCONDUCTORES PARA TECNOLOGÍAS CUÁNTICAS: VISUALIZANDO Y MANIPULANDO CORRELACIONES TRIPLETE

Reference: PID2020-114071RB-I00

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/09/2021- 31/08/2024

PI: SUDEROW RODRIGUEZ, HERMANN JESUS

54. ÓPTICA DE LUZ MAGNETO-ELÉCTRICA EN MEDIOS NANOSTRUCTURADOS DIELECTRICOS

Reference: PGC2018-095777-B-C22

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/01/2019- 31/12/2022

PI: MARQUES PONCE, MANUEL IGNACIO

55. PHOTONIC TAILORING OF NANOMATERIALS: EXTRAORDINARY LIGHT HARVESTING IN EXCITONIC SYSTEMS

Reference: PGC2018-097236-A-I00

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/01/2019- 31/12/2022

PI: PRINS, FERRY

56. PLANTA DE LICUEFACCIÓN DE HELIO PARA LA CIENCIA Y TECNOLOGÍA CERCA DEL CERO ABSOLUTO

Reference: EQC2021-007277-P

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/06/2021- 31/12/2023

PI: SUDEROW RODRIGUEZ, HERMANN JESUS

57. PRODUCCIÓN DE HIDRÓGENO POR DISOCIÓN ELECTROQUÍMICA DE AGUA ASISTIDA POR FOTOCATALIZADORES CON CONTROL DE ESPÍN

Reference: TED2021-131042B-I00

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/12/2022- 30/11/2024

PI: MIGUEL LLORENTE, JUAN JOSE DE

58. PRODUCCIÓN Y MANIPULACIÓN CONTROLABLE DE ESTADOS CUÁNTICOS DE LUZ EN SEMICONDUCTORES BIDIMENSIONALES

Reference: PID2020-113415RB-C21

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/09/2021- 31/08/2024 PI: LAZIC, SNEZANA

59. PROPIEDADES CUÁNTICAS DE LA LUZ EMITIDA POR UNA UNIÓN TÚNEL

Reference: PGC2018-096047-B-I00

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/01/2019- 30/06/2022

PI: OTERO MARTIN, ROBERTO

60. QUIRALIDAD Y HELICIDAD EN LA NANOESCALA DESDE PRIMEROS PRINCIPIOS

Reference: PID2019-109539GB-C43

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/06/2020- 31/05/2023

PI: PALACIOS BURGOS, JUAN JOSE

61. REDES METAL-ORGÁNICAS DE DISEÑO ATÓMICO: ARQUITECTURAS POROSAS PARA LA ELIMINACIÓN DE CONTAMINANTES EMERGENTES

Reference: RTI2018-096138-A-I00

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/01/2019- 30/09/2022

PI: PLATERO PRATS, ANA EVA

62. RETOS Y OPORTUNIDADES DE LAS TECNOLOGÍAS SUPERCONDUCTORAS EN LA AVIACIÓN COMERCIAL SIN EMISIÓNES DE GASES INVERNADERO

Reference: TED2021-130546B-I00

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/12/2022 - 30/11/2024

PI: SUDEROW RODRIGUEZ, HERMANN JESUS

63. SIESTA Y SU INTEROPERABILIDAD PARA LOS NUEVOS RETOS EN SIMULACIONES ATOMÍSTICAS (SIESTA-UAM)

Reference: PGC2018-096955-B-C42

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/01/2019- 31/12/2022

PI: SOLER TORROJA, JOSE MARIA

64. SIMULACIÓN DE OPTOELECTRÓNICA MOLECULAR RESUELTA EN EL TIEMPO CON EL CÓDIGO XCHEM

Reference: PDC2021-121073-I00

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/12/2021- 30/11/2023

PI: MARTIN GARCIA, FERNANDO

65. SIMULACIÓN MULTIESCALA DE MATERIALES POROSOS AVANZADOS

Reference: TED2021-129886B-C44

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/12/2022- 30/11/2024

PI: TARAZONA LAFARGA, PEDRO JOSE

66. SUPERCOMPUTACIÓN, ALMACENAMIENTO Y BIG DATA

Reference: EQC2021-007589-P

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/06/2021- 31/12/2023

PI: GARCIA VIDAL, FCO. JOSE

67. SUPERCONDUCTIVIDAD EN LA NANOSCALE: DISPOSITIVOS CUÁNTICOS DE 0 A 2D

Reference: PID2020-117671GB-I00

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/09/2021- 31/08/2024
PI: LEVY-YEYATI MIZRAHI, ALFREDO

68. TECNOLOGÍAS CUÁNTICAS A TEMPERATURA AMBIENTE

Reference: PCI2018-093145
Funding institution: AGENCIA ESTATAL DE INVESTIGACION
Period: 01/03/2018- 30/06/2022
PI: GARCIA VIDAL, FCO. JOSE

69. TECNOLOGÍAS POLARITONICAS CUÁNTICAS

Reference: RTI2018-099737-B-I00
Funding institution: AGENCIA ESTATAL DE INVESTIGACION
Period: 01/01/2019- 30/09/2022
PI: FEIST, JOHANNES MAXIMILIAN

70. TENSIONES MECÁNICAS EN COMPONENTES LAMINARES DE IONES LITIO: LA MURALLA A FRANQUEAR PARA EL USO DE BATERÍAS DE LI EN APLICACIONES INTENSIVAS

Reference: PCI2019-103594
Funding institution: AGENCIA ESTATAL DE INVESTIGACION
Period: 01/03/2019- 28/02/2023
PI: POLOP JORDA, CELIA

71. TRANSFERENCIA DE ENERGIA Y ELECTRONES EN MATERIALES SOLIDOS LUMINISCENTES ACTIVADOS POR LANTANIDOS MULTIVALENTES

Reference: MAT2017-83553-P
Funding institution: MINISTERIO DE ECONOMIA Y COMPETITIVIDAD
Period: 01/01/2018- 30/06/2022
PI: SEIJO LOCHE, LUIS IGNACIO

72. TRANSPORTE DE CALOR Y TERMOELECTRICIDAD EN CONTACTOS MOLECULARES

Reference: PID2020-114880GB-I00
Funding institution: AGENCIA ESTATAL DE INVESTIGACION
Period: 01/09/2021- 31/08/2024
PI: CUEVAS RODRIGUEZ, JUAN CARLOS

73. TRANSPORTE Y MANIPULACIÓN DEL CALOR EN EL RÉGIMEN CUÁNTICO

Reference: PID2019-110125GB-I00
Funding institution: AGENCIA ESTATAL DE INVESTIGACION
Period: 01/06/2020- 31/05/2023
PI: SANCHEZ RODRIGO, RAFAEL

74. VIRTUAL-QCM: SOFTWARE CIENTÍFICO PARA REPRODUCIR EXPERIMENTOS EN MICROBALANZAS DE CUARZO A PARTIR DE PRIMEROS PRINCIPIOS

Reference: PDC2021-121441-C21
Funding institution: AGENCIA ESTATAL DE INVESTIGACION
Period: 01/12/2021- 30/11/2023
PI: DELGADO BUSCALIONI, RAFAEL

75. UNIONES JOSEPHSON BASADOS EN ACOPLAMIENTO ESPIN-ORBITA PARA MEMORIAS CRIOGÉNICAS NO DISIPATIVAS

Reference: TED2021-130196B-C22

Funding institution: AGENCIA ESTATAL DE INVESTIGACION

Period: 01/12/2022- 30/11/2024

PI: ALIEV KAZANSKI, FARKHAD

Regional R&D Projects:

1. ACELERACIÓN Y ESCALADO

Reference: 2021/00334/001

Funding institution: AYUNTAMIENTO DE MADRID

Period: 01/11/2021-30/11/2022

PI: ZAMORA ABANADES, FELIX JUAN

2. AYUDA PARA LA REALIZACION DE DOCTORADO INDUSTRIAL EN LA COMUNIDAD DE MADRID. Doctorando Cristina Arqueros Albay. Convocatoria 2020

Reference: IND2020/IND-17321

Funding institution: COMUNIDAD DE MADRID

Period: 05/02/2021-04/02/2024

PI: ZAMORA ABANADES, FELIX JUAN

3. AYUDA PARA LA REALIZACION DE DOCTORADO INDUSTRIAL EN LA COMUNIDAD DE MADRID. Doctorando Miguel Ángel Chamorro Villanueva. Convocatoria 2019

Reference: IND2019/AMB-17242

Funding institution: COMUNIDAD DE MADRID

Period: 03/02/2020-02/02/2023

PI: ZAMORA ABANADES, FELIX JUAN

4. Centro de Innovación digital en Biociencias, Biotecnología y Salud (DIH-bio)

Reference: OI2020-UAM-7.0

Funding institution: COMUNIDAD DE MADRID

Period: 29/11/2021-30/06/2023

PI: ZAMORA ABANADES, FELIX JUAN

5. ECOSISTEMA DE INNOVACIÓN MADRIDNORTE: KNODE

Reference: OI2019-UAM-115659

Funding institution: COMUNIDAD DE MADRID

Period: 01/01/2020-31/12/2022

PI: ZAMORA ABANADES, FELIX JUAN

6. Electron transport through protein-based hybrid junctions and role of mutations

Reference: SI3/PJI/2021-00191

Funding institution: COMUNIDAD DE MADRID

Period: 01/01/2022-31/12/2023

PI: ZOTTI, LINDA ANGELA

7. Excelencia profesorado universitario Catedrático de Universidad - Física de la Materia Condensada

Reference: 2020/00338/001

Funding institution: COMUNIDAD DE MADRID

Period: 01/01/2020-31/12/2024

PI: AGRAIT DE LA PUENTE, MARIO NICOLAS

8. EXCELENCIA PROFESORADO UNIVERSITARIO CATEDRÁTICO/A DE UNIVERSIDAD - FÍSICA DE LA MATERIA CONDENSADA

Reference: 2021/00037/001

Funding institution: COMUNIDAD DE MADRID

Period: 01/01/2021-31/12/2024

PI: ALIEV KAZANSKI, FARKHAD

9. EXCELENCIA PROFESORADO UNIVERSITARIO CATEDRÁTICO/A DE UNIVERSIDAD - QUÍMICA INORGÁNICA

Reference: 2021/00041/001

Funding institution: COMUNIDAD DE MADRID

Period: 01/01/2021-31/12/2024

PI: ZAMORA ABANADES, FELIX JUAN

10. EXCELENCIA PROFESORADO UNIVERSITARIO PROFESOR CONTRATADO DOCTOR - FÍSICA DE LA MATERIA CONDENSADA

Reference: 2020/00331/001

Funding institution: COMUNIDAD DE MADRID

Period: 01/01/2020-31/12/2024

PI: AGRAIT DE LA PUENTE, MARIO NICOLAS

11. EXCELENCIA PROFESORADO UNIVERSITARIO PROFESOR CONTRATADO DOCTOR - FÍSICA TEÓRICA DE LA MATERIA CONDENSADA

Reference: 2020/00327/001

Funding institution: COMUNIDAD DE MADRID

Period: 01/01/2020-31/12/2024

PI: LEVY-YEYATI MIZRAHI, ALFREDO

12. EXCELENCIA PROFESORADO UNIVERSITARIO PROFESOR TITULAR DE UNIVERSIDAD - FÍSICA DE LA MATERIA CONDENSADA

Reference: 2020/00336/001

Funding institution: COMUNIDAD DE MADRID

Period: 01/01/2020-31/12/2024

PI: AGRAIT DE LA PUENTE, MARIO NICOLAS

13. EXCELENCIA PROFESORADO UNIVERSITARIO PROFESOR/A CONTRATADO/A DOCTOR/A - FÍSICA DE LA MATERIA CONDENSADA

Reference: 2021/00051/001

Funding institution: COMUNIDAD DE MADRID

Period: 01/01/2021-31/12/2023

PI: JAAFAR RUIZ-CASTELLANOS, MIRIAM

**14. EXCELENCIA PROFESORADO UNIVERSITARIO PROFESOR/A CONTRATADO/A
DOCTOR/A - FÍSICA DE LA MATERIA CONDENSADA**

Reference: 2021/00048/001

Funding institution: COMUNIDAD DE MADRID

Period: 01/01/2021-31/12/2024

PI: VALLE REBOUL, ELENA DEL

**15. EXCELENCIA PROFESORADO UNIVERSITARIO PROFESOR/A TITULAR DE UNIVERSIDAD
- FÍSICA DE LA MATERIA CONDENSADA**

Reference: 2021/00034/001

Funding institution: COMUNIDAD DE MADRID

Period: 01/01/2021-31/12/2024

PI: OTERO MARTIN, ROBERTO

16. MICROSCOPIA MAGNÉTICA MULTIPARAMÉTRICA CON ALTA SENSIBILIDAD

Reference: SI1/PJI/2019-00055

Funding institution: COMUNIDAD DE MADRID

Period: 01/01/2020-30/09/2022

PI: JAAFAR RUIZ-CASTELLANOS, MIRIAM

**17. MICROSCOPIO DE FUERZAS ATÓMICAS TECNOLÓGICO EN UHV PARA NANOCIRCUITOS
ULTRA LIMPIOS.**

Reference: SI3/PJI/2021-00479

Funding institution: COMUNIDAD DE MADRID

Period: 01/01/2022-31/12/2023

PI: ARES GARCIA, PABLO

**18. NANOFOTÓNICA PARA COMPUTACIÓN CUÁNTICA (NANOQUCO-CM) GRUPO:
QNALIGHT**

REFERENCE: Y2020/TCS-6545

Funding institution: COMUNIDAD DE MADRID

Period: 01/07/2021-30/06/2024

PI: GARCIA VIDAL, FCO. JOSE

**19. NUEVOS MATERIALES BIDIMENSIONALES: CARACTERIZACIÓN, PROPIEDADES Y
APLICACIONES - G2-UAM**

Reference: S2018/NMT-4511

Funding institution: COMUNIDAD DE MADRID

Period: 01/01/2019-30/04/2023

PI: BRIHUEGA ALVAREZ, IVAN

20. SOLUCIONES DEL NANOMAGNETISMO A LOS RETOS SOCIALES - 287

Reference: S2018/NMT-4321

Funding institution: COMUNIDAD DE MADRID

Period: 01/01/2019-30/04/2023

PI: RAMOS RUIZ, MIGUEL ANGEL

21. SOLUCIONES DEL NANOMAGNETISMO A LOS RETOS SOCIALES - LASUAM

Reference: S2018/NMT-4321

Funding institution: COMUNIDAD DE MADRID

Period: 01/01/2019-30/04/2023

PI: MIRANDA SORIANO, RODOLFO

22. SOLUCIONES DEL NANOMAGNETISMO A LOS RETOS SOCIALES - LBT-UAM

Reference: S2018/NMT-4321

Funding institution: COMUNIDAD DE MADRID

Period: 01/01/2019-30/04/2023

PI: SUDEROW RODRIGUEZ, HERMANN JESUS

23. INCENTIVOS A LA PRESENTACIÓN DE PROPUESTAS A HORIZONTE EUROPA - FERRY PRINS

Reference: 1001030276

Funding institution: SERVICIO DE INVESTIGACION UAM

Period: 01/07/2022-30/06/2023 PI: PRINS, FERRY

24. INCENTIVOS A LA PRESENTACIÓN DE PROPUESTAS A HORIZONTE EUROPA - SALVATORE ASSENZA

Reference: 1001050141

Funding institution: SERVICIO DE INVESTIGACION UAM

Period: 01/07/2022-30/06/2023

PI: ASSENZA, SALVATORE

Private Funding:

CONVENIO BANCO SANTANDER-UAM-IFIMAC

Reference: SANTANDER UNIVERSIDADES

Funding institution: BANCO DE SANTANDER CENTRAL HISPANO SA

Period: 18/06/2016-31/12/2024

PI: GARCIA VIDAL, FCO. JOSE

3.3 SCIENTIFIC RESULTS

Publications

1. Lopez-Polin G; Gomez-Navarro C; Gomez-Herrero J, *The effect of rippling on the mechanical properties of graphene*, 2022, **Nano Materials Science**; 4 (1) 18-26
10.1016/j.nanoms.2021.05.005

2. González-Ruano C; Tiusan C; Hehn M; Aliev FG, Boosting Room Temperature Tunnel Magnetoresistance in Hybrid Magnetic Tunnel Junctions Under Electric Bias, 2022, **Advanced Electronic Materials**; 8 (1), 100805
10.1002/aelm.202100805
3. Mishra, Debadarshini; Reino-Gonzalez, Juan; Obaid, Razib; LaForge, Aaron C.; Diaz-Tendero, Sergio; Martin, Fernando; Berrah, Nora, *Ultrafast molecular dynamics in ionized 1-and 2-propanol: from simple fragmentation to complex isomerization and roaming mechanisms*, 2022, **Physical Chemistry Chemical Physics**; 24 (1) 433-443
10.1039/d1cp04011a
4. de Pablo PJ; San Martín C, *Seeing and touching adenovirus: complementary approaches for understanding assembly and disassembly of a complex virion*, 2022, **Current Opinion In Virology**; 52,112-122
10.1016/j.coviro.2021.11.006
5. Barreiro-Lage, Dario; Nicolafrancesco, Chiara; Kocisek, Jaroslav; Luna, Alberto; Kopyra, Janina; Alcami, Manuel; Huber, Bernd A.; Martin, Fernando; Domaracka, Alicja; Rousseau, Patrick; Diaz-Tendero, Sergio, *Controlling the diversity of ion-induced fragmentation pathways by N-methylation of amino acids*, 2022, **Physical Chemistry Chemical Physics**; 24 (2) 941-954
10.1039/d1cp04097a
6. Fallaque, Joel G.; Rodriguez-Gonzalez, Sandra; Diaz, Cristina; Martin, Fernando, *A simple model to engineer single-molecule conductance of acenes by chemical disubstitution*, 2022, **Nanoscale**; 14 (2) 464-472
10.1039/d1nr06687k
7. Toral-Lopez, A.; Santos, H.; Marin, E. G.; Ruiz, F. G.; Palacios, J. J.; Godoy, A.;, Multi-scale modeling of 2D GaSe FETs with strained channels, 2022, **Nanotechnology**; 33 (10) –
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8. Garg, M.; Martin-Jimenez, A.; Pisarra, M.; Luo, Y.; Martin, F.; Kern, K.;, *Real-space subfemtosecond imaging of quantum electronic coherences in molecules*, 2022, **Nature Photonics**; 16 (3) 196-202
10.1038/s41566-021-00929-1
9. Seitz, Michael; Melendez, Marc; York, Peyton; Kurtz, Daniel A.; Magdaleno, Alvaro J.; Alcazar-Cano, Nerea; Kshirsagar, Anuraj S.; Gangishetty, Mahesh K.; Delgado-Buscalioni, Rafael; Congreve, Daniel N.; Prins, Ferry, *Halide Mixing Inhibits Exciton Transport in Two-dimensional Perovskites Despite Phase Purity*, 2022, **Acs Energy Letters**; 7 (1) 358-365
10.1021/acsenergylett.1c02403
10. García-Arroyo P; Martínez-Periñán E; Cabrera-Trujillo JJ; Salagre E; Michel EG; Martínez JI; Lorenzo E; Segura JL, *Pyrenetetraone-based covalent organic framework as an effective electrocatalyst for oxygen reduction reaction*, 2022, **Nano Research**; 15 (5) 3907-3912
10.1007/s12274-021-4043-2
11. Garnica, M.; Otkrov, M. M.; Casado Aguilar, P.; Klimovskikh, I. I.; Estyunin, D.; Aliev, Z. S.; Amiraslanov, I. R.; Abdullayev, N. A.; Zverev, V. N.; Babanly, M. B.; Mamedov, N. T.; Shikin, A. M.; Arnau, A.; Vazquez de Parga, A. L.; Chulkov, E., V; Miranda, R., *Native point defects and their implications for the Dirac point gap at MnBi₂Te₄(0001)*, 2022, **Npj Quantum Materials**; 7 (1), 7

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12. Martin-Illan, Jesus A.; Antonio Suarez, Jose; Gomez-Herrero, Julio; Ares, Pablo; Gallego-Fuente, Daniel; Cheng, Youdong; Zhao, Dan; Maspoch, Daniel; Zamora, Felix, *Ultralarge Free-Standing Imine-Based Covalent Organic Framework Membranes Fabricated via Compression*, 2022, **Advanced Science**; 9 (7) e2104643

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13. Martinez-Fernandez, Marcos; Gavara, Raquel; Royuela, Sergio; Fernandez-Ecija, Laura; Martinez, Jose Ignacio; Zamora, Felix; Segura, Jose L., *Following the light: 3D-printed COF@poly(2-hydroxyethyl methacrylate) dual emissive composite with response to polarity and acidity*, 2022, **Journal Of Materials Chemistry a**; 10 (9) 4634-4643

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14. Torres I; Villa-Manso AM; Revenga-Parra M; Gutiérrez-Sánchez C; Aldave DA; Salagre E; Michel EG; Varela M; Gómez-Herrero J; Lorenzo E; Pariente F; Zamora F, *Preparation of high-quality few-layers bismuthene hexagons*, 2022, **Applied Materials Today**; 26, 101360

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15. Biswas K; Yang L; Ma J; Sánchez-Grande A; Chen Q; Lauwaet K; Gallego JM; Miranda R; Écija D; Jelínek P; Feng X; Urgel JL, *Defect-Induced π-Magnetism into Non-Bzenenoid Nanographenes*, 2022, **Nanomaterials**; 12 (2), 224

10.3390/nano12020224

16. Bareza NJ; Paulillo B; Slipchenko TM; Autore M; Dolado I; Liu S; Edgar JH; Vélez S; Martín-Moreno L; Hillenbrand R; Pruneri V, *Phonon-Enhanced Mid-Infrared CO₂Gas Sensing Using Boron Nitride Nanoresonators*, 2022, **Acs Photonics**; 9 (1) 34-42

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17. Dong, ZG; Mahfoud, Z; Paniagua-Dominguez, R; Wang, HT; Fernandez-Dominguez, Al; Gorelik, S; Ha, ST; Tjiptoharsono, F; Kuznetsov, Al; Bosman, M; Yang, JKW, *Nanoscale mapping of optically inaccessible bound-states-in-the-continuum*, 2022, **Light-Science & Applications**; 11 (1), 20

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18. Sánchez-Grande A; Nguyén HC; Lauwaet K; Rodríguez-Fernández J; Carrasco E; Cirera B; Sun Z; Urgel JL; Miranda R; Lauritsen JV; Gallego JM; López N; Écija D, *Electrically Tunable Reactivity of Substrate-Supported Cobalt Oxide Nanocrystals*, 2022, **Small**; 18 (12) e2106407-10.1002/smll.202106407

19. Guerra C; Kumar S; Aguilar-Galindo F; Díaz-Tendero S; Lozano Al; Mendes M; Oller JC; Limão-Vieira P; García G, *Total Electron Detachment and Induced Cationic Fragmentation Cross Sections for Superoxide Anion (O₂⁻) Collisions with Benzene (C₆H₆) Molecules*, 2022, **International Journal Of Molecular Sciences**; 23 (3), 1266

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20. Zundel L; Cuartero-González A; Sanders S; Fernández-Domínguez Al; Manjavacas A, *Green Tensor Analysis of Lattice Resonances in Periodic Arrays of Nanoparticles*, 2022, **ACS Photonics**; 9 (2) 540-550

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10.1109/TMAG.2021.3089373
24. Martínez-Fernández M; Martínez-Periñán E; Royuela S; Martínez JI; Zamora F; Lorenzo E; Segura JL, *Covalent organic frameworks based on electroactive naphthalenediimide as active electrocatalysts toward oxygen reduction reaction*, 2022, **Applied Materials Today**; 26, 101384
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25. Ganguly, Smita; Barreiro-Lage, Dario; Walsh, Noelle; Oostenrijk, Bart; Sorensen, Stacey L.; Diaz-Tendero, Sergio; Gisselbrecht, Mathieu,; *The origin of enhanced O₂(+) production from photoionized CO₂ clusters*, 2022, **Communications Chemistry**; 5 (1), 16
10.1038/s42004-022-00629-z
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10.3390/nano12030558
27. D'olimpio G; Farias D; Kuo CN; Ottaviano L; Lue CS; Boukhvalov DW; Politano A, *Tin Diselenide (SnSe₂) Van der Waals Semiconductor: Surface Chemical Reactivity, Ambient Stability, Chemical and Optical Sensors*, 2022, **Materials**; 15 (3), 1154
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National and International congresses: invited lectures

1. "Antiferromagnetic magnon pseudospin and Hanle effect". A. Kamra **Joint European Magnetic Sym-posia (JEMS)** 2022, Warsaw, Poland.
2. "Quantum Magnonics: Realizing ideas from quantum optics with magnets, and going beyond!", A. Kamra. **Spin Cavitronics IV Workshop**, Max Planck Institute for the Science of Light (MPL), Er-langen, Germany.
3. "Detection and manipulation of Andreev states in hybrid nanowire Josephson junctions using cQED techniques", A. Levy, **Hybrid Solid State Quantum Circuits, Sensors, and Metrology**, 13-16 December 2021, Bad Honnef Germany
4. "Novel signatures of interactions in hybrid nanowire Josephson junctions", A. Levy, **Workshop Topological Quantum Matter**, Universidad de San Martín, 4-8 April 2022 Buenos Aires
5. "Theory of interactions and cQED detection of Andreev bound states in nanowire Josephson junctions", A. Levy workshop "**Quantum microwaves, heat transfer and many-body physics in mesoscopic superconducting devices**", 16-20 May 2022, ICTP, Trieste
6. "Mechanics of defective 2D materials" C. Gómez-Navarro **Flatlands beyond graphene**, 2022, Lanzarote Spain
"
7. "Mechanics of defective 2D materials" C. Gómez-Navarro, **Nature conference: Chemistry of 2D materials**, 2022
8. "Mechanics of defective 2D materials", C. Gómez-Navarro, **Bienal de la RSEF** , Murcia Spain 2022
9. "Electron-phonon coupling and thermal expansion in superconducting 2D materials." D. Farías, **Fifth International Workshop on Scattering of Atoms and Molecules from Surfaces**.12/09/2022. Cambridge (UK),
"
10. 'Nanophotonics in Toruń', D. Martín Cano, **Aleksander Jabłoński Foundation and the Nicolaus Copernicus University in Toruń**, September 18-21, 2022, Toruń, Poland.
"
11. "Foremost photonics 2022", D. Martín Cano. Costanza Toninelli, October 10-14, 2022, in Sicily, Italy.

12. "Heating effects in hybrid superconductor-semiconductor devices". E. Lee, **CMD29 (29th Conference of the Condensed Matter Division of the European Physical Society)**, 21/08/2022-26/08/2022, Manchester, England.
13. "Towards quantum devices based on hybrid superconductor-semiconductor nanostructures" E. Lee **22nd IEEE International Conference on Nanotechnology**, 04-08/07/2022, Palma de Mallorca, Spain.
14. "Superconducting spintronics with spin-orbit interaction and symmetry filtering" F. G. Aliev, C. González-Ruano, D. Caso, P. Tuero, L. G. Johnsen, C. Tiusan, M. Hehn, J. Fabian, N. Banerjee, J. Linder. **14th International Conference on Physics of Advanced Materials**, 2022, Dubrovnik, Croacia"
15. "Visualizing Energy Transport in Nanocrystal Thin-Films". F. Prins. **NanoGe Spring meeting**, March 2022,
16. "Computational methods and tools for complex suspensions". Juan L. Aragones **CECAM**, May 23 – 27, 2022. Bilbao (Spain)
17. "Dispersions: Drops, Particles and Bugs", Laura R. Arriaga. **Science, Startups and Success**, May 31 – June 4, 2022. Benasque (Spain).
18. "Enantioselective adsorption on chiral and magnetic substrates" J. J. de Miguel **Workshop on "Electronic and Magnetic Properties of Chiral Structures and their Assemblies"**, 26 - 30 junio 2022. Telluride (EE.UU.), .
19. "From amino acids to proteins: electron transport and mechanical deformation", L. Zotti **Biderived Electronics** 15-19/05/2022 (Israel)
"Polariton condensates co-directional waveguide couplers (PI)". L. Viña. **Workshop on "Semiconductors, nanostructures, 2D systems and Dirac matter"**, junio 2022, Grenoble (Francia).
20. "Polariton condensates in co-directional couplers (PI)" E. Rozas, J. Lizarraga, A. Yulin, J. Beierlein, S. Klembt, S. Höfling M. D. Martín and L. Viña **International Conference on Hybrid Photonics & Materials**, octubre 2022, Hydra (Grecia).
21. "Novel routing devices for polariton condensates (PI)" E. Rozas, I. Robles-Lopez, J. Lizarraga, M.D. Martín, and L. Viña **International Workshop on 2D materials**, octubre 2022, Varsovia (Polonia).
22. "Manipulating the emission of rare earth quantum emitters by plasmonic chains" L.E. Bausá **9th International Conference on Optical, Optoelectronic and Photonic Materials and Applications ICOOPMA-22**, 3-8/7/2022, Gante, Bélgica.
23. "Electrostatic doping modulation in monolayer MoS2 through ferroelectric domain patterns" P. Molina, J. Fernandez-Tejedor, D. Gallego-Fuente, P. Ares, J. Gomez-Herrero, L. E.

Bausá and M.O Ramírez **7th International Workshop on Advanced Spectroscopy and Optical Materials IWASOM'22.** 10-15/7/2022, Gdansk, Polonia

24. "Plasmonic arrangements on crystalline gain media for solid state nanolasers" L.E. Bausá **7th European Conference on Crystal Growth ECCG7 .** 25-27/7/2022, París, Francia

25. "Ferroelectrically driven lateral MoS₂ p-n homojunctions probed by optical spectroscopy" J. Fernandez-Tejedor, D. Gallego-Fuente, P. Molina, P. Ares, J. Gomez-Herrero, L. E. Bausá and M.O Ramírez **22 International Conference on Dynamical Processes of States States of Solids DPC22** 4-9/9/2022 Wroclaw, Polonia.

26. "Novel features of plasmon-assisted solid-state lasers at the nanoscale" L.E. Bausá, **Nanolight,** 6-10/3/ 2022 Benasque, España

27. "Optical forces and complex suspensions" M. Marqués, **Computational methods and tools for complex suspensions,** 23-27 May, 2022 Bilbao, Spain

28. "Magneto optical binding in the near field" M. Marqués **Meta 2022,** 19-22 July, 2022, Torremolinos, Spain & Online,"

29. "Some few Highlight's on Mole's research on optical forces" M. Marqués **Mole Conference** 25-29/7/ 2022 San Sebastian, Spain,

30. "Magneto optical binding in the near field" M. Marqués, **WCLOP-2022,** 18-21/9/2022 Miami (USA) & Online, "

31. "Magneto optical binding in the near field" M. Marqués, **OPL-202,** 29-11 November 2022 Online "

32. "Active motion induced by random electromagnetic fields" M. Marqués, **Active Days 2022,** 5-7 December 2022, Paris, France

33. "Quantum spin liquids and superconductivity in honeycomb molecular materials" J. Merino, **SPICE-Workshop (Mainz): New spin on molecular quantum materials,** 24-26 May 2022. Mainz, Germany

34. "Study of few-layer antimonene electrical properties by Scanning-Probe-Assisted Nanowire Circuitry". P.Ares. **NanoSeries conference on Global Nanotechnology,** 06/2022, Virtual.

NanoSeries Innovation Award for "outstanding work in driving the nanotechnologies forward".

35. R. Delgado Buscalioni **4th COODy-Nano (Collective Optofluidic Dynamics of Nanoparticles)** Workshop, 3-4 November, 2022. National Yang Ming Chiao Tung University (NYCU)

36. "Current-driven dynamics and ratchet effect of skyrmion bubbles in a ferrimagnetic insulator" Saül Vélez, Sandra Ruiz-Gómez, Jakob Schaab, Elzbieta Gradauskaitė, Martin S. Wörnle, Paul Welter, Benjamin J. Jacot, Christian L. Degen, Morgan Trassin, Manfred Fiebig,

Pietro Gambardella, **67th Annual Conference on Magnetism and Magnetic Materials (MMM 2022)**, 31 October – 4 November 2022. Minneapolis, USA

37. “*Current-Driven Dynamics of Néel Domain Walls and Skyrmions in Magnetic Insulators*”, Saül Vélez **International Conference on Quantum Materials and Technologies (ICMQT)**, 16-22 October 2022. Milas-Bodrum, Turkey.

38. “*Current-induced control of chiral magnetic textures in magnetic insulators*” Saül Vélez, **Joint European Magnetic Symposia 2022 (JEMS)**, 24-29 July 2022 Warsaw, Poland.

39. “*Current-induced control of chiral magnetic textures in magnetic insulators*”, Saül Vélez, **International Meeting on Magnetism and Magnetic Materials (MAGNETISMMEET 2022)**, 18-20 April 2022. Online Conference.

“

40. “*Ultrafast dynamics of photoionized alcohols and nitriles in the gas phase*” S. Diaz Tendero **MPS2022 – International Conference on Many Particle Spectroscopy of Atoms, Molecules, Clusters and Surfaces** 15- 17 June 2022. Turku, Finland.

41. “*Ultrafast processes in amino-acids, amino-acids derivatives and clusters of amino-acids induced by ionizing radiation*” S. Diaz Tendero **ECAMP14 – 14th European Conference on Atoms Molecules and Photons**. 27 June- 1 July 2022. Vilnius, Lithuania.

42. “*Ultrafast dynamics of ionized molecules and molecular clusters in the gas phase*” S. Diaz Tendero **SPIG2022 – 31st Summer School and International Symposium on the Physics of Ionized Gases**, 5-9 September 2022. Belgrade, Serbia Date.

43. “*Electrical and Thermal Transport in Molecular Junctions*”, Nicolás Agrait, **15th European School on Molecular Nanoscience (ESMolNa2022) & the 9th Workshop on 2D Materials (W2DM2022)**, 22- 26 May 2022 Tordesillas (Valladolid, Spain).

44. “*Measuring the thermal and electrical conductance of atomic contacts using a novel hotwire-thermocouple scanning probe microscope*”, Nicolás Agrait, **Photon, Phonon, and Electron Transitions in Coupled Nanoscale Systems, 745. WE-Heraeus-Seminar**, 19 - 23 September 2022, Bad Honnef (Germany).

45. “*Atomic force microscopy images carry chemical information: Halogen bonds, Tautomerization, and molecular identification with deep learning*”. R. Perez. **12th International Conference on Porphyrins and Phthalocyanines (ICPP-12)** Society of Porphyrins & Phthalocyanines 10-15/07/2022 Madrid

46. “*Effect of Molecule-Substrate Interaction on the Adsorption of Meso-Dibenzoporphycene Tautomers Studied by Scanning Probe Microscopy and First-Principles Calculations*”. R. Perez, **NanoSpain, Phantoms Foundation**. 17-20/05/2022 Madrid

47. “*Atomic force microscopy images carry key chemical information: Halogen bonds, tautomerization, and molecular identification with deep learning*”. R. Pérez **RIVA 2022 – XII Iberian Vacuum and Applications Conference**, Spanish Vacuum Society (ASEVA) and the Portuguese Vacuum Society (SOPORVAC), 15- 17/05/2022 Braga (Portugal)

48. "Atomic force microscopy images carry key chemical information: Halogen bonds, tautomerization, and molecular identification with deep learning". R. Pérez **ACS Spring 2022 (ACS Award in Surface Chemistry 2022: Symposium in honor of Miquel Salmeron)**, ACS,20-24/3/2022 San Diego (CA, USA), online participation, 3/21/2022
49. "Hydrodynamics of quartz crystal microbalance experiments using discrete molecules". R. Delgado-Buscalioni "**1st Spanish Fluid Mechanics Conference**", Cádiz, June 19-22, 2022
50. "Chiral spintronics with magnetic insulators", Saül Vélez, **XXXVIII Reunión Bienal de la Real Sociedad Española de Física, Magnetism Symposia**, Murcia, Spain, 11-15 July 2022.

Organization of congresses

1. **Mini-colloquium “Bound states in hybrid superconductor nanostructures”** Condensed Matter Division of the European Physical Society 29th Meeting, (Manchester, 21-26 August 2022). Co-organized by Alfredo Levy
2. **Online FermiPolar Workshop - Fermi Polarons: from ultracold gases to 2D semiconductors**, (online, 07-18 February 2022). <https://www.ifimac.uam.es/fermipolar-workshop-07-18-feb-2022/> Co-organized by Francesca Marchetti
3. **XXVIII International Summer School Nicolas Cabrera on “The Physics of Bio-inspired and Biological Systems: From Emergent Behaviors to Functional Materials”**, (Miraflores de la Sierra, Madrid (Spain), 2-7 September, 2022). Organized by Juan L. Aragones, Laura R. Arriaga and Raul Guantes.
4. **7th International Workshop on Advanced Spectroscopy and Optical Materials** (Gdansk, Polonia, July 2022) Luisa Bausá member of the International Scientific Committee.
5. **International Conference on Dynamical Processes on Excited States of Solids DPC22** (Wroclaw, Polonia, 4-9 setiembre 2022). Luisa Bausá member of the International Advisory Committee
6. **SPIE Photonics Europe. Symposium: Fiber lasers and Glass Photonics**. (Strasbourg, France, April 2022). M. O. Ramírez member of the Program Committee
7. **International Conference on Materials Science, Engineering & Technology** (Singapore, September 2022). María. O. Ramírez member of the Program Committee
8. **Nanospain conference 2022**, (Madrid, Spain 17-20 May 2022). Co-organized by Manuel Marqués
9. **SummerLIB: fundamentals, materials and applications of lithium-ion batteries** <https://civis.eu/en/civis-courses/summerlib-fundamentals-materials-and-applications-of-lithium-ion-batteries> (11-12 July 2022). Co-organized by Celia Polop

10. **Computational methods and tools for complex suspensions** (Bilbao, Basque Country, Spain, 23-27 May, 2022). Co-organized by Rafael Delgado-Buscalioni

11. **DEEP-GAS 2022: “Dynamics of Energetic & Electronic Processes in molecules and clusters in the GAS phase”** MD-GAS COST Action (CA18212) meeting, (Madrid (Spain) October 4th to 7th 2022). Co-organized by Sergio Díaz-Tendero

12. **ZCAM-ASEVA Workshop on Metal-Oxide Ultrathin Films and Nanostructures** ZCAM, ASEVA (Asociación Española del Vacío y sus Aplicaciones) Zaragoza Center for Advanced Modelling (ZCAM), (Zaragoza, 4-8 July 2022). Co-organized by Rubén Pérez

13. **Cold Atom Workshop (CAW)** (Madrid 24-25 November 2022), <https://sites.google.com/view/caw-madrid-2022/home> Co-organized by Francesca Marchetti.

14. **Symposium “Advances in nanomaterials characterization by Atomic Force Microscopy”** in the XXXVIII Biennial of Physics of the Spanish Royal Physics Society (RSEF), (Murcia, Spain 11-15 July 2022). Co-organized by Pablo Ares, Miriam Jaafar Ruiz-Castellanos and Guilherme Vilhena

15. **‘Novel Frontiers and Challenges in Magnetism’ Symposium** within XXXVIII Reunión Bienal de la Real Sociedad Española de Física (Murcia, Spain, 11-15 July 2022). Co-organized by Miriam Jaafar.

Sponsorships

1. **Nanospain Conference 2022** (*Madrid, May 17-20, 2022*), organized by Antonio Correia (Fundación Phantom), Pedro Echenique(Donostia International Physics Center), Manuel Marqués (IFIMAC/Universidad Autónoma de Madrid), Lars Montelius (INL (Portugal)), Jose Manuel Perlado Martin (IFN-GV & ETSII/UPM), Juan José Saenz (DIPC - In memoriam), Josep Samitier (IBEC/Universidad de Barcelona), Daniel Sanchez Portal (CSIC - UPV/EHU - DIPC), Pedro A. Serena (ICMM-CSIC)
<https://www.nanospainconf.org/2022/committees.php>

2. **"Advances in nanomaterials characterization by Atomic Force Microscopy" Symposium** within **XXXVIII Bienal de la Real Sociedad Española de Física (RSEF)** (*Murcia, July 11-15*) organized by Elisa Palacios Lidón (Universidad de Murcia), Pablo Ares García, (IFIMAC/Universidad Autónoma de Madrid), Carmen Munuera López (Instituto de Ciencia de Materiales de Madrid, ICMM-CSIC), Miriam Jaafar Ruiz-Castellanos (IFIMAC/Universidad Autónoma de Madrid), Guilherme Vilhena (IFIMAC/Universidad Autónoma de Madrid)
<https://gefes-rsef.org/advances-in-nanomaterials-characterization-by-atomic-force-microscopy-bienal-rsef-2022/>

3. **‘Novel Frontiers and Challenges in Magnetism’ Symposium** within **XXXVIII Reunión Bienal de la Real Sociedad Española de Física** (*Murcia, July 11-15*) organized by Jose Angel Fernández-Roldán (Universidad de Oviedo), Miriam Jaafar (IFIMAC, Universidad Autónoma de

Madrid), Irene Lucas, (Universidad de Zaragoza), Ester M. Palmero (IMDEA Nanociencia, Madrid), Luis Moreno (Universidad de Sevilla)

<https://gefes-rsef.org/novel-frontiers-and-challenges-in-magnetism-bienal-rsef-july-11-15-2022/>

4. Support to the 10th edition of the GEFES awards for the best doctoral thesis in condensed Matter Physics.

<https://gefes-rsef.org/x-edicion-premios-de-tesis-gefes-2022/>

PATENT applications

1. A COMPUTER IMPLEMENTED METHOD FOR IDENTIFYING A MOLECULE FROM ATOMIC FORCE MICROSCOPY IMAGES AND GENERATING THE NAME OF SAID MOLECULE ACCORDING TO THE IUPAC NOMENCLATURE

Jaime Carracedo Cosme, Rubén Pérez Pérez

Application number: P202230398

Date of application: 29/04/2022

UAM, Quasar Science Resources SL

Countries: Spain, Oficina Española de Patentes y Marcas

2. A COMPUTER IMPLEMENTED METHOD FOR IDENTIFYING A MOLECULE FROM ATOMIC FORCE MICROSCOPY IMAGES BY GENERATING A 2D COLORED RGB STRUCTURAL REPRESENTATION OF SAID MOLECULE IN THE FORM OF A BALL-AND-STICK DEPICTION

Jaime Carracedo Cosme, Rubén Pérez Pérez

Application number: P202230396

Date of application: 29/04/2022

UAM, Quasar Science Resources SL

Countries: Spain Oficina Española de Patentes y Marcas

3. NANOREACTORS FOR THE SYNTHESIS OF POROUS CRYSTALLINE MATERIALS

Félix Zamora, David Rodríguez

Date of application: 18 de febrero de 2021

Priority number: EP18179325.8 (Entrada en fase nacional de la solicitud PCT No.:PCT/EP2019/066526)

Country: China nº 201980054690X

UNIVERSIDAD AUTÓNOMA DEMADRID

4. NANOREACTORS FOR THE SYNTHESIS OF POROUS CRYSTALLINE MATERIALS

Félix Zamora, David Rodríguez

Date of application: 22 de diciembre de 2020

Priority number: EP18179325.8 (Entrada en fase nacional de la solicitud PCT No.:PCT/EP2019/066526)

Country: Estados Unidos nº 17/255,121

UNIVERSIDAD AUTÓNOMA DEMADRID

5. NANOREACTORS FOR THE SYNTHESIS OF POROUS CRYSTALLINE MATERIALS

Félix Zamora, David Rodríguez

Date of application: 18 de enero de 2021

Priority number: EP18179325.8 (Entrada en fase nacional de la solicitud PCT No.:PCT/EP2019/066526)

Country: European patent application nº EP19736609.9

UNIVERSIDAD AUTÓNOMA DE MADRID

6. NANOREACTORS FOR THE SYNTHESIS OF POROUS CRYSTALLINE MATERIALS

Félix Zamora, David Rodríguez

Date of application: 17 de enero de 2022

Priority number: EP18179325.8 (Entrada en fase nacional de la solicitud PCT No.:PCT/EP2019/066526)

Country: Hong Kong nº 62022046474.2

UNIVERSIDAD AUTÓNOMA DE MADRID

7. NANOREACTORS FOR THE SYNTHESIS OF POROUS CRYSTALLINE MATERIALS

Félix Zamora, David Rodríguez

Date of application: 21 de diciembre de 2020

Priority number: EP18179325.8 Entrada en fase nacional de la solicitud PCT No.:PCT/EP2019/066526"

Country: Japón nº 2020-571441

UNIVERSIDAD AUTÓNOMA DE MADRID

Awards

Miriam Jaafar, IFIMAC member, recognized with a Special Mention in the 1st edition of the Award for the best Invention protected by Industrial Property granted in 2020.

Miriam Jaafar was recognized with a Special Mention in the Woman Inventor category, for her patent ES2711860, "Sistema para un microscopio de fuerzas atómicas", in the first edition of the Award for the best Invention protected by Industrial Property granted in 2020. Julio Gómez and Pablo Ares, IFIMAC members, also participated as co-inventors of this patent.

The objective of these awards is to distinguish the protection of research results through Patents and Utility Models granted in 2020 by the Spanish Patent and Trademark Office, recognizing the value of protected and competitively positioned in the market, Spanish R&D and supporting and promoting research, and scientific and technological activity.



Francisco José García-Vidal Included In Clarivate 2022 Compilation Of Most Influential Authors



Each year, Clarivate™ identifies the world's most influential researchers – the select few who have been most frequently cited by their peers over the last decade. In 2022, fewer than 7,000, or about 0.1%, of the world's researchers, in 21 research fields and across multiple fields, have earned this exclusive distinction.

Francisco José García-Vidal is, for the seventh time, among this elite group recognized for its exceptional research influence, demonstrated by the production of multiple highly-cited papers that rank in the top 1% by citations for field and year in the Web of Science™.

In the 2022 edition there are only two researchers, in the physics category, from Spain, among the world's most influential

researchers: Francisco José García-Vidal (IFIMAC-UAM) and Francisco Guinea (IMDEA Nanociencia)

Pablo Ares recognized with an “Innovation Award”

Dr. **Pablo Ares** was recognized with an “Innovation Award” during the first edition of the NanoSeries Conference, celebrated online on June 21-24.

The award committee highlighted «his thought-provoking presentation on “Study of Few-Layer Antimonene Electrical Properties by Scanning-Probe-Assisted Nanowire Circuitry”».

These awards were given to the individual presenters with outstanding work in driving the nanotechnologies forward.



4. TRAINING AND OUTREACH ACTIVITIES

4.1 MASTER AND DOCTORATE PROGRAMMES

IFIMAC members are actively involved in the Master Programmes:

- Máster Universitario en Física de la Materia Condensada y de los Sistemas Biológicos
- Máster Universitario en Química Teórica y Modelización Computacional
- Máster Universitario en Materiales Avanzados, Nanotecnología y Fotónica
- Máster Universitario en Química Aplicada

And in the Doctorate programmes:

- Física de la Materia Condensada, Nanociencia y Biofísica
- Programa de Doctorado en Materiales Avanzados y Nanotecnología
- Química Teórica y Modelización Computacional
- Química Aplicada

4.2 IFIMAC's MASTER FELLOWSHIPS

IFIMAC has offered 12 grants for the best students starting the Masters of Condensed Matter Physics within UAM.

- 2021/2022 course: five Master grants awarded:

1.- **Martínez Martínez, Pablo** (Máster en Física de la Materia Condensada y de los Sistemas Biológicos BIOFÍSICA)

TFM Supervisor: David Miguez"

2.- **Ocio Moliner, Mikel** (Máster en Física de la Materia Condensada y de los Sistemas Biológicos BIOFÍSICA)

TFM Supervisor: David Miguez"

3.- **Gonzalez Lastre, Manuel Eduardo** (Master en Física de la Materia Condensada y los Sistemas Biológicos (BIOFISICA))

TFM Supervisor: Raul Guantes

4.- **Sagasta Beltran de Guevara, Ander** (Master en Química Teórica y Modelización Computacional)

TFM Supervisor: Fernando Martín

5.- **Osuna Bris, Eva** (Master en Física de la Materia Condensada y los Sistemas Biológicos (NANOFISICA))

TFM Supervisor: Cristina Gómez-Navarro González.

- 2022/2023 course: five Master grants awarded:

1.- **De la Peña Ruiz, Sebastián** (Máster en Física de la Materia Condensada y de los Sistemas Biológicos)

TFM Supervisor: Juan Carlos Cuevas

2.- **Viña Bausá, Beatriz María** (Máster en Física de la Materia Condensada y de los Sistemas Biológicos, NANOFÍSICA)

TFM Supervisor: Iván Brihuega

3.- **Fernandez Écija, Laura** (Máster en Nuevos Alimentos)

TFM Supervisor: Félix Zmora Abanades

4.- **Molina Hernandez, Javier** (Máster en Física de la Materia Condensada y de los Sistemas Biológicos, BIOFÍSICA)

TFM Supervisor: David Miguez Gómez

5.- **Diez Silva, Pablo** (Máster en Física de la Materia Condensada y de los Sistemas Biológicos, NANOFÍSICA)
TFM Supervisor: Linda Angela Zotti

6.- **Tuero Álvarez, Pablo** (Máster en Física de la Materia Condensada y de los Sistemas Biológicos NANOFÍSICA)
TFM Supervisor: Farkhad Aliev

4.3 RESEARCH AWARDS FOR PHYSICS STUDENTS

The Condensed Matter Physics Center provides two of the six awards called by The Nicolas Cabrera Institute

The candidates awarded by IFIMAC in the 2022 edition are:

- Youhuang Yang
- Senlin Yue

https://www.inc.uam.es/wp-content/uploads/Cartel_Awards-Physics-Students-2022.pdf

4.4 OUTREACH

1. Quantum Matter Seminars, “Andreev states in hybrid nanowire Josephson junctions”, Northeastern University; February, 23th 2022. **Alfredo Levy**

2. Quantum matter and energy Seminars “Detection and manipulation of Andreev states in hybrid nanowire Josephson junctions”, Universidad de Pamplona, Colombia; December, 17th 2022 **Alfredo Levy**

3. FUTURO Cuántico, online event. Participation on an online encounter with industry professionals for discussions around quantum technologies; with the talk: “Quantum Metrology” **Carlos Sánchez**

4. Artworks for outreach. **Carlos Sánchez** won the competition Quantum Visions, a quantum-themed art context organized by UK National Quantum Technologies Programme (UKNQTP), aiming to promote quantum sciences through artworks. “A Brumal Coherence”
<https://www.quantumcity.org.uk/news/artwork-dreams-wins-first-prize-quantum-visions-competition>

5. Dissemination project “La Física de la Materia Condensada sale al encuentro” from FECYT running through a collaboration with the Youtube channel Quantum Fracture that accounts more than 3M subscribers. PI: **Cristina Gómez-Navarro**; Members: **Luisa E. Bausá, Rubén Pérez, Antonio Fernandez- Domínguez, Félix Zamora**

6. Book: D. Farías, J. C. Cuevas. Las ideas que cambiaron el mundo. Biblioteca Buridán, 368 pages
ISBN-13: 978-8417700072. Popular science book about relativity theory and quantum mechanics

7. Dissemination talk, "Ecuaciones de Maxwell: Nanofotónica y óptica cuántica" Jornadas de divulgación de investigación del FTMC, **Diego Martín Cano**

8. Outreach to Society of Soft Matter and Biophysics by BBVA:

<https://www.fbbva.es/noticias/escuela-nicolas-cabrera-reune-lideres-mundiales-en-biofisica/>

Interviews to the Summer School speakers in "El Mundo" and "ABC" newspapers:

<https://www.elmundo.es/papel/historias/2022/09/06/631783ab21efa068298b45a6.html>

<https://www.abc.es/ciencia/monica-olvera-robot-anda-agua-quiero-meterlo-20220911151316-nt.html> **Juan L. Aragónés and Laura R. Arriaga**

9. News in Print Media:

<https://www.lavanguardia.com/vida/20220708/8394443/autonoma-investiga-interfaces-metales-aplicacion-tecnologia.html>

Linda A. Zotti

10. Member of the National Committee of the DÍA INTERNACIONAL DE LA LUZ (diadelaluz.es). **María de la O Ramírez**

11. Media interviews: Interview about atomic force microscopy on Onda Bierzo. January, 22th 2022.

https://www.ivoox-com.cdn.ampproject.org/v/s/www.ivoox.com/magazine-onda-bierzo-sabado-laura-sanchez-22-audios-mp3_rf_81189282_amp_1.html?amp_js_v=a6&gsa=1&usqp=mq331AQKKAQArABIIACA_w%3D%3D#aoh=16429512595530&ct=1642951261966&referrer=https%3A%2F%2Fwww.google.com&tf=De%20%251%24s&share=https%3A%2F%2Fwww.ivoox.com%2Fmagazine-onda-bierzo-sabado-laura-sanchez-22-audios-mp3_rf_81189282_1.html

Pablo Ares

12. Media interviews: Interview about atomic force microscopy on Radio Bierzo SER. January, 20th 2022. Cadena SER.

https://cadenaser.com/audio/ser_aso_bierzo_hoyporhoybierzo_20220120_122000_140000/

Pablo Ares

13. Conference "Microscopios de fuerzas atómicas: herramientas de la nanotecnología y puerta al mundo" Ciclo de divulgación científica La Central Divulga.. Organising entity: La Fábrica de Luz, Museo de la Energía de Ponferrada. Ponferrada, Spain; January 20th 2022. **Pablo Ares**

14. Media interviews: Interview in the TV show 8 Magazine Bierzo. La 8 Bierzo. January 19th 2022. https://youtu.be/6U9_pNVMYXA?t=1840

Pablo Ares

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15. **International Day of Women and Girls in Science:**

The Condensed Matter Physics Center joined the celebration of the International Day of Women and Girls in Science through a series of talks in different schools and secondary schools, given by IFIMAC members.

Celia Gonzalez participated in the initiative #100tífiques – <https://100tificues.cat/>, organized by a consortium of research institutes. She gave talk at Col·legi Sagrada Família Sant Andreu de Barcelona on February 11th.

Celia Gonzalez “Acerando la ciencia al instituto”, IES Cruz Santa de Tenerife, February 9th, and “La ciencia también es cosa nuestra”, IES Eulogio Florentino Sanz, Arevalo (Avila), February 16th.

Marta Fernández-Lomana “Física de bajas temperaturas (Superconductores)” Colegio Mirasol (Fuencarral) for the student of 2nd grade of bachillerato category in sciences, February 23rd.

Cristina Gómez-Navarro “Mama quiero ser científica... ¿y ahora qué?”, BBVA “Move for equality” working group, February 10th.

Miriam Jaafar Ruiz-Catellanos “Conociendo a una científica del nanomundo” for the students from 1st and 2nd grade of Bachillerato category, Colegio Esclavas del Sagrado Corazón de Jesús (Madrid), March, 3rd.

Linda Zotti “Electrónica molecular: ¿qué es eso? Y qué hace una mujer trabajando en eso?”, Colegio Altair Internacional (Madrid), March 14th.

16. Outreach videos in collaboration with QuantumFracture:

Since 2017, we have kept a fruitful collaboration with the youtube channel QuantumFracture and QuantumFractureEN (<https://www.youtube.com/user/QuantumFracture>), devoted to scientific outreach in Spanish and English. Since then, we have generated 7 videos that have received more than 7 million views. The first video, “La física de lo complejo”, provided a general perspective on the field of Condensed Matter Physics, as well as the research performed at IFIMAC. A team of 7 IFIMAC researchers were involved in its realization. The following videos dealt with different topics of intense research activity worldwide, in which IFIMAC researchers play an important role. They were coordinated by 1-2 IFIMAC researchers each, who offered their particular vision on the topic in question. The titles of the videos were: “El cristal que se alimenta de entropía”, “Cómo el microscopio más potente del mundo acabó en España”, “El quinto estado de la materia: superfluidos y superconductores”, “El material cuántico que se enfriá al sol”, y “Ya, en serio, ¿qué es la luz?”. These videos can be also found (both in Spanish and in English) in our webpage and youtube channel: <https://www.ifimac.uam.es/outreach/>, <https://www.youtube.com/c/ifimac>.

Finally, in 2022, we have been awarded a FICYT grant entitled “La física de la materia condensada sale al encuentro”, within the “Convocatoria de Ayudas para el fomento de la cultura científica, tecnológica y de la innovación”. This funding is being employed to support the generation of new outreach audiovisual materials. The first (“Cómo se Fabrica un Bit Cuántico. Átomos Artificiales”) of the three videos planned for this project was published in November 2022.

5. HUMAN RESOURCES

5.1 New researchers affiliated during 2022

New members proposed by IFIMAC Researchers:

- Carlos Antón Solanas (Talent grant)



Carlos Anton Solana's area of expertise is experimental nanophotonics and solid-state quantum optics. Carlos obtained his PhD at the Univ. Autonoma of Madrid in 2015. Then he became a postdoctoral researcher at C2N-CNRS, France. Until 2019, he worked on solid state quantum optics, using quantum dots coupled to micropillar cavities. Afterwards, he obtained an Individual Marie Skłodowska-Curie Fellowship to work on “Scalable Quantum Photonics with Ultra Bright Photon Sources”. During his 2nd postdoc at University of Würzburg, 2019-2020 and University of Oldenburg, 2020-2022,

Germany, he worked on excitons and exciton polaritons and single photon emitters in atomically thin crystals of transition metal dichalcogenides. In 2022 he incorporated to IFIMAC with a “Talent grant CM”

- Jose Guilherme Vilhena Alburquerque (Talent grant)



Jose Guilherme multi-disciplinary research is tied together by the quest for understanding and controlling novel properties emerging at the nanoscale – and endeavour the development and use of state-of-the-art computational techniques often in a synergistic collaboration with experiments. He recently joined IFIMAC thanks to a ‘Atracción de Talento Senior – Comunidad de Madrid’ with the aim of taming the exotic form of ballistic heat transport emerging at the nanoscale. This phenomena leads to the breakdown of classical laws and calls for a novel formalism capable of accurately accounting for both quantum statistics and anharmonic effects. The technological interest of such developments ultimately fueled yet another project within the “Transición Ecológica y Digital” call .

- Herko Piet van der Meulen (Professor)



Herko van der Meulen obtained his degree in Physics at the University of Utrecht (the Netherlands) and did his PhD in Physics at the University of Amsterdam on the subject of specific heat measurements in high magnetic fields of heavy fermion systems and high temperature superconductors. He designed the setup and measured the specific heat of heavy fermion systems for the first time up to fields of 24.5 T in the High Field Magnet Laboratory at the University of Nijmegen. Afterwards he stayed as a postdoc in that laboratory, extending the measurements to thermal expansion experiments.

From 1994 onwards, he joined the Universidad Autónoma de Madrid (Spain). Here he started working on spectroscopy of semiconductor nanostructures. First in semiconductor quantum wells, where he measured the quantum Hall effect at 0.3 K, simultaneously by optical and electrical means. Afterwards the investigations were dedicated to

quantum dots, quantum optics and photon correlation measurements, contributing to the group's first publication in Spain on single photon emission by semiconductor quantum dots.

- María Dolores Martín Fernández (Professor):



María Dolores Martín is an associate professor at the Materials Physics department of Universidad Autónoma of Madrid. Her main research lines are all within solid state physics, focusing on the optical, electronic and spin properties of semiconductors and their nanostructures. She is a member of the SEMICUAM group and a board member of the INC. She has participated in 30 competitive research projects, leading several of them, published 71 articles on international peer reviewed journals and presented the main findings of her research in numerous international conferences and workshops, by invitation on many occasions.

5.2 IFIMAC MEMBERS

Surname and name	Professional category	Department	Research line/s
AGRAÏT DE LA PUENTE, Nicolás	Catedrático de Universidad	FMC	NP
ALIEV KAZANSKI, Farkhad	Catedrático de Universidad	FMC	AM
ÁLVAREZ ALONSO, Jesús	Titular de Universidad	FMC	NP AM
ÁLVAREZ CARRERA, José Vicente	Contratado Doctor	FMC	FPSM,NP
ANTÓN SOLANAS, Carlos	Atracción de Talento	FM	AM, NQO
ARAGONÉS GÓMEZ, Juan Luis	Investigador RyC	FTMC	SCMB
Ares García, Pablo	Investigador RyC	FTMC	AM, NP
ASSENZA, Salvatore	La Caixa Junior Leader	FTMC	SCMB
BAUSÁ LÓPEZ, Luisa E.	Catedrática de Universidad	FM	AM, NQO
BRAVO ABAD, Jorge	Contratado Doctor	FTMC	NQO
BRIHUEGA ALVAREZ, Iván	Contratado Doctor	FMC	AM, NP
Burset Atienza, Pablo	Research Fellow CM-Talento	FTMC	NP, AM
BURZURÍ LINARES, Enrique	Investigador RyC	FMC	NP, AM
CAMARERO DE DIEGO, Julio	Titular de Universidad	FMC	AM, NP
CINACCHI, Giorgio	Contratado Doctor	FTMC	SCMB,AM
CORTIJO ALBERTO	Investigador RyC	FMC	FPSM
CUEVAS RODRÍGUEZ, Juan Carlos	Titular de Universidad	FTMC	NP, NQO
DELGADO BUSCALIONI, Rafael	Contratado Doctor	FTMC	SCMB
DIAZ-TENDERRO VICTORIA, Sergio	Contratado Doctor	Q	FPSM
FARIAS TEJERINA, Daniel	Titular de Universidad	FMC	NP

Surname and name	Professional category	Department	Research line/s
FEIST Johannes	Investigador RyC	FTMC	NQO
FERNÁNDEZ DOMÍNGUEZ, Antonio I.	Contratado Doctor	FTMC	NQO
FLORES SINTAS, Fernando	Profesor Emérito	FTMC	NP,FPSM
GARCÍA GONZÁLEZ, Pablo	Titular de Universidad	FTMC	FPSM,NQO
GARCÍA MICHEL, Enrique	Catedrático de Universidad	FMC	AM,NP
GARCÍA MOCHALES, Pedro	Contratado Doctor	FMC	FPSM
GARCÍA VIDAL, Francisco José	Catedrático de Universidad	FTMC	NQO
GÓMEZ HERRERO, Julio	Catedrático de Universidad	FMC	NP,AM
GÓMEZ-NAVARRO GONZÁLEZ, Cristina	Titular de Universidad	FMC	AM,NP
GÓMEZ MÍGUEZ, David	Contratado Doctor	FMC	SCMB
GÓMEZ SANTOS, Guillermo	Titular de Universidad	FMC	FPSM
GUANTES NAVACERRADA, Raúl	Contratado Doctor	FMC	SCMB
GUILLAMÓN GÓMEZ, Isabel	Contratado Doctor	FMC	AM
Jaafar Ruiz-Castellanos, Miriam	Contratado doctor	FMC	AM NP
Kamra, Akashdeep	Joven Investigador IFIMAC	FTMC	AM, NP
LAZIC, Snezana	Contratado Doctor	FM	NP
LEE, Eduardo Jian Hua	Investigador RyC	IFIMAC	NP, AM
LEVY YEYATI, Alfredo	Catedrático de Universidad	FTMC	NP,AM
LÓPEZ VÁZQUEZ DE PARGA, Amadeo	Catedrático de Universidad	FMC	NP
MARCHETTI, Francesca María	Contratado Doctor	FTMC	NQO
MARQUÉS PONCE, Manuel	Titular de Universidad	FM	NQO
MARTÍN CANO, Diego	La Caixa Junior Leader	FTMC	NQO
MARTÍN FERNÁNDEZ, María Dolores	Titular de Universidad	FM	NQO
MARTÍN GARCÍA, Fernando	Catedrático	Q	NP, FPSM
MERINO TRONCOSO, Jaime	Titular de Universidad	FTMC	AM
MIGUEL LLORENTE, Juan José de	Titular de Universidad	FMC	AM,NP
MIRANDA SORIANO, Rodolfo	Catedrático de Universidad	FMC	NP,AM
MONREAL VÉLEZ, Rosa	Catedrática de Universidad	FTMC	NP,NQO
MORENO SORIANO, Esteban	Titular de Universidad	FTMC	NQO
MORI SÁNCHEZ, Paula	Contratado doctor	Q	FPSM
ORTEGA MATEO, José	Catedrático de Universidad	FTMC	FPSM
OTERO MARTÍN, Roberto	Titular de Universidad	FTMC	AM, NP
PABLO GÓMEZ, Pedro José de	Titular de Universidad	FMC	SCMB,NP
PALACIOS BURGOS, Juan José	Catedrático de Universidad	FMC	NP,FPSM
PÉREZ PÉREZ, Rubén	Catedrático de Universidad	FTMC	NP,FPSM
Platero Prats, Ana Eva	Investigadora RyC	QI	AM
POLOP JORDÁ, Celia	Titular de Universidad	FTMC	AM, NP

Surname and name	Professional category	Department	Research line/s
PORTO ORTEGA, Juan Antonio	Contratado Doctor	FTMC	NQO
POU BELL, Pablo	Contratado Doctor	FTMC	FPSM,NP
PRINS, Ferry	Investigador RyC	FMC	NQO
RAMÍREZ HERRERO, Mariola	Contratado Doctor	FM	AM, NQO
RAMOS RUIZ, Miguel Ángel	Titular de Universidad	FMC	AM,SCMB
RODRIGO RODRIGUEZ, José Gabriel	Titular de Universidad	FMC	AM
RODRÍGUEZ ARRIAGA, Laura	Investigadora RyC	FTMC	SCMB
RUBIO BOLLINGER, Gabino	Catedrático de Universidad	FMC	NP AM
Sánchez Rodrigo, Rafael	Investigador RyC	FTMC	NP
SEGOVIA CABRERO, Pilar	Titular de Universidad	FMC	AM, NP
SANCHEZ MUÑOZ, Carlos	La Caixa Junior Leader	FTMC	NQO
SEJO LOCHÉ, Luis	Catedrático de Universidad	Q	FPSM
SOLER TORROJA, Jose María	Catedrático de Universidad	FMC	FPSM
SUDEROW RODRÍGUEZ, Hermann	Titular de Universidad	FMC	AM, NP
TARAZONA LAFARGA, Pedro	Catedrático de Universidad	FTMC	SCMB
TEJEDOR DE PAZ, Carlos	Profesor Emérito	FTMC	NQO
VALLE REBOUL, Elena del	Contratado Doctor	FTMC	NQO, NP
VAN DER MEULEN, Herko	Titular de Universidad	FM	AM, NQO
VIEIRA DÍAZ, Sebastián	Profesor Emérito	FMC	AM
VILHENA, GUILHERME	Atracción de Talento	FTMC	NP FPSM
VIÑA LISTE, Luis	Catedrático de Universidad	FM	NQO
VELASCO CARAVACA, Enrique	Titular de Universidad	FTMC	SCMB
Velez Centoral Saul	Joven Investigador IFIMAC	FMC	AM, NP
YNDURAIN MUÑOZ, Félix	Profesor Emérito	FMC	FPSM
ZAMORA ABANADES, Félix	Catedrático de Universidad	QI	AM
ZOTTI, Linda Ángela	Ayudante doctor	FTMC	NP, FPSM

Acronyms

Departments

FMC: Física de la Materia Condensada

FTMC: Física Teórica de la Materia Condensada

FM: Física de Materiales

QI: Química Inorgánica

Q: Química

Research Lines

NP: Nanophysics

AM: Advanced Materials

SCMB: Soft Condensed Matter and Biophysics

FPSM: First-principles Simulations and Modeling

NQO: Nano and Quantum Optics

6. BUDGET

GASTOS		INGRESOS	
Previsión de gastos de personal, gastos corrientes de funcionamiento y equipamiento e inversiones.	a) Gastos de personal	332.430,75 €	Estimación de ingresos por actividad propia. 863.132,80 €
	b) gastos corrientes de funcionamiento	108.654,40 €	
	c) equipamiento e inversiones	18.112,39 €	
TOTAL GASTOS	459.197,54 €	TOTAL INGRESOS	863.132,80 €